THE ENGINEER.

BRITISH CONCRETE MACHINERY.

British Concrete Machinery.

THE use of concrete has, during recent years, extended greatly. It is, of course, employed in practically all civil engineering operations, and, latterly, as the result of the demand for quickly built houses and the difficulty in obtaining bricks, it has been used in great quantity as the chief material in the construction of dwellings. The demand was one of the outcomes of the war, and on account of it the war may be regarded has having brought about a considerable development in machines and apparatus for the manufacture of blocks, bricks, slabs, &c., of sizes and shapes specially suitable for building purposes. Yet the war was undoubtedly responsible for delaying, in this country at any rate, the more extensive use of concrete-mixing and other machines, which, long before the outbreak of hostilities, were being made by many of our manufacturers.

Now, although the nation has not, as yet, so far reinstated its financial position as to be able to undertake engineering constructional work on a large scale, yet the building operations alluded to above, together with the activity in road-making and repair, which is apparent on all sides, has resulted in a heavy call for all kinds of machinery for making concrete and for dealing with it when made. Though it is doubtless true that the hand mixing of concrete, when properly carried out, gives the best results from the point of view of the efficiency of the finished material, yet with labour as high in cost as it is, and in view of its comparative slowness, it has been necessary to resort to mechanical substitutes, and of these islands. It was with the object of making it clear that neither for concrete mixers nor for machines for utilising or distributing it when made was it in any way necessary to look across the sea, that the information contained in this Supplement was collected. Many of our makers have, for years now, been constructing machines which produce results every bit as good as those obtained with machines of American or other foreign origin, and there is no excuse whatever for going abroad for machinery to make concrete, to take it from the mixer to the point where it is to be deposited, or to fashion it into articles of no matter what shape or form.

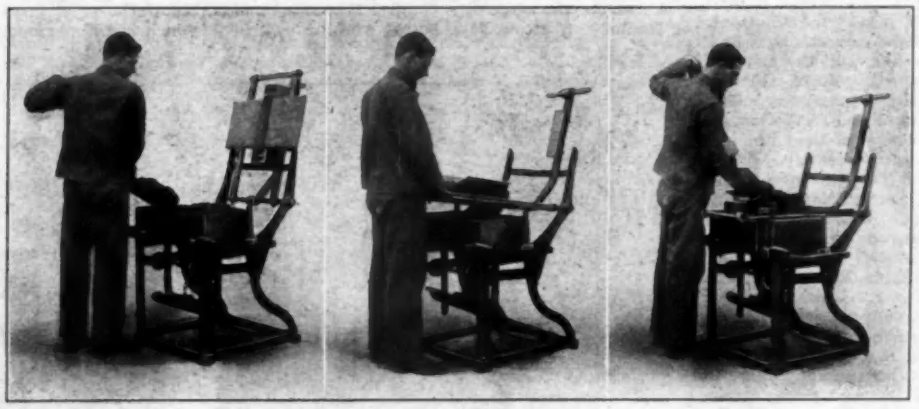


FIG. 1—THE AUSTRALIA CONCRETE BLOCK-MAKING MACHINE

It was originally intended to include in the Supplement descriptions of British crushing and other machines required in the preparation of the raw materials used in concrete making. Questions of space, however, precluded the carrying out of that intention, and we have been obliged to omit reference to crushing machinery as such. It will be observed that the firms, the machines of which are discussed in what follows, are arranged in alphabetical order.

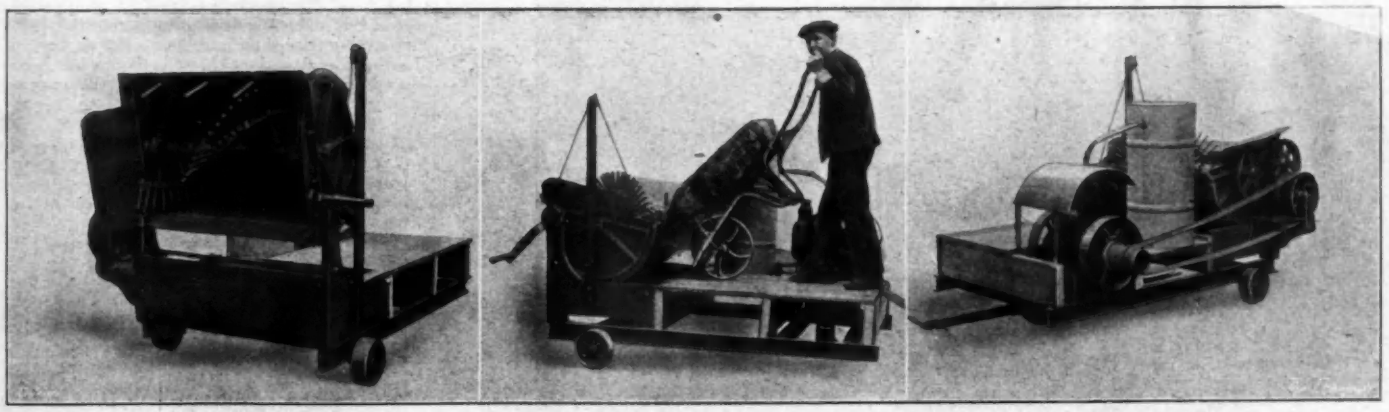


FIG. 2—THE TONKIN CONCRETE MIXING MACHINE

concrete-mixing machines it may be said that, when carefully designed and handled, they produce results that are practically identical with those achieved by hand labour. At any rate, they are being used in ever-increasing numbers in engineering works of the greatest importance.

Recently there has been a regrettable tendency to import foreign concrete machinery, especially from the United States, where, for several reasons which it is not necessary to discuss at the moment, the mechanical making and handling of concrete has been, hitherto, more widely adopted than it has been in

THE AUSTRALIA CONCRETE MACHINERY AND ENGINEERING COMPANY, LIMITED.

Two interesting machines are made by the Australia Concrete Machinery and Engineering Company, Limited, of 607, Salisbury House, London-wall, E.C. 2. They are the Tonkin mixer, and the Australia concrete block machine, and they are illustrated in the engravings given above. The former can either be operated by hand—two men, it is claimed, being able to produce more concrete than will four men hand mixing—or it may be power-driven, as shown in the right-hand view. The mixing pan is of trough section, and is open at the top so that the process of mixing may be watched. Revolving in it is a horizontal axle furnished with steel arms, set at different angles, to which are fitted renewable steel rake pins, their arrangement somewhat resembling an open hand with the fingers extended. There are two sets of these rakes, and in both, the pins are arranged at such angles that, when revolving, one set turns the material from the end to the centre of the pan, while the other set reverses the movement, the complete revolution and turning over process being repeated twenty-five times each minute. To discharge the mixed concrete the pan is revolved on its bearings by means of the hand wheel and wire rope, as will be seen in the left view in the engraving. On the feeding side of the mixing pan there are vertically projecting pegs, the duty of which is to stop the edges of a barrow bringing the ingredients to be mixed so that it is easy to discharge the latter by tipping the barrow. The mixing pan has a capacity of 3 cubic feet per load, and we gather that as many as 90 cubic yards of concrete have been produced by one machine in actual service in an eight hours' day, while 60 cubic yards is quite an ordinary day's production for two men.

The Australia block-making machine is comparatively light, only weighing some 4 cwt., and its overall dimensions are just over 3ft. long and 2ft. wide by 4ft. high. With it, it is claimed, an able-bodied man can make, on an average, 350 faced blocks or 450 breeze slabs in one day. Only one man is actually necessary to work the machine, but two, or even three, can be usefully employed if the maximum output is desired. It can make any type of square slab up to a maximum of 2ft. long by 1ft. wide by 4in. thick, and numerous other shaped articles, such as T-section blocks, reveals, mullions, quoins, street kerbs, verandah kerbs, floor slabs, piers, columns, gateposts, plinth blocks, string courses, copings, corner blocks, chimney flue blocks, &c. For blocks which are subsequently to be plastered, wooden pallets are recommended, though, of course, for rock-faced or any other type of imitation stones, cast iron pallets must be used. The thickness of the block made is determined by the depth of packing inserted underneath the pallet. The mould box is in one piece,

and not with hinged sides. It is provided with a false bottom, which can be made to move vertically up and down by a treddle which, by means of a chain, revolves a shaft having keyed to it two toothed pinions which gear with two racks attached to and depending from the underside of the false bottom. In making a block, a pallet of the correct size is first of all dropped into the mould box, and the latter is then filled with mixed concrete, the top of which is then roughly levelled with a trowel or scraper. The ramming plate, which is seen attached to the hinged frame at the back of the machine, is then brought forward and slammed downwards smartly several times until the block is rammed hard and level. The rammer frame is then swung backwards against its rest and the treddle is depressed with the result that the block on its pallet is pushed up clear of the mould box and can be lifted away. It is, of course, apparent that, by means of suitable fillets, the blocks can be made so that they have interlocking ends or given any other required shape. For making T-section blocks the procedure is the same up to a certain point as for slabs. For the former, however, an adaptor plate, as it is called, which, when making slabs, is employed to fill up a central hole—extending across the ramming plate—is removed. Then, when the slab part of the block has been made and rammed, the rammer plate is allowed to remain down on the face of the slab. The "nib," or T part of the block is then made by filling a properly shaped mould formed on the back of the rammer plate with concrete and ramming by means of the hinged "nib" rammer seen in the central and right-hand views in Fig. 1. When ramming is completed, the "nib" rammer and then the slab rammer are lifted and swung back, and the finished block is then raised out of the mould by depressing the treddle. The blocks are moulded and carried away on the flat which, the makers point out, enables the concrete to be mixed with the prescribed quantity of water recommended by the Concrete Institute. After twelve hours the blocks can be turned on their edges and left to mature.

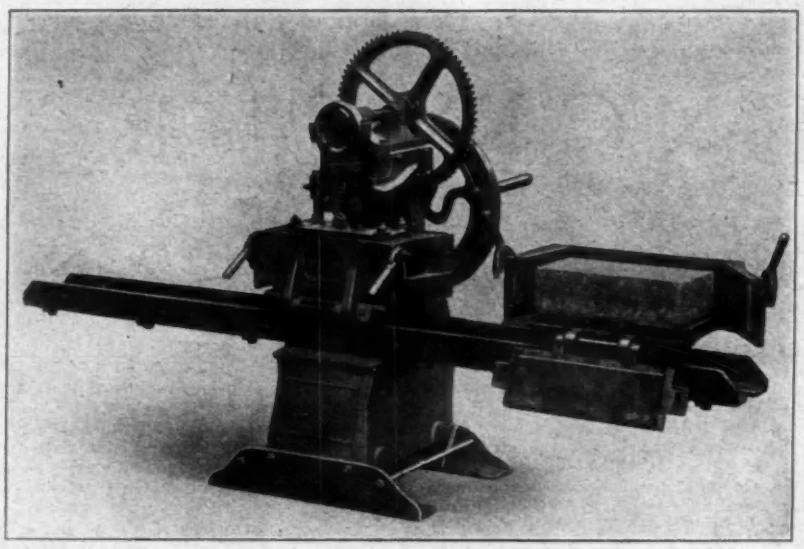


FIG. 3—THE DEARD CONCRETE BLOCK-MAKING MACHINE—BAYLISS AND CO.

Bayliss and Co., Limited.

A machine for which it is claimed that it is capable of turning out in an eight hours' working day 1000 concrete blocks measuring 18in. by 9in. by 4½in., or 130 coke breeze partition slabs per hour, is made by Bayliss and Co., Limited, of 240 and 241, Dashwood House, New Broad-street, London, E.C. 2. As a matter of fact, in actual practice, two of the machines, in the hands of the Unit Construction Company, Limited, on its Crossens-Southport house-building contract, averaged 2400 blocks per day of eight hours over a period of two months, the two machines on one particular day actually producing 3320 blocks in the eight hours, or an average of 1660 per machine.

The machine, which is the invention of Mr. S. Deard, is shown in Fig. 3. It consists of a main casting, on a vertically projecting portion of which is mounted the gearing for compressing the blocks or slabs, and of an angle iron runway 6ft. 7½in. long, which is mounted on a stepped platform formed in the base of the main casting. On the runway two mould boxes travel on wheels. Each mould box can produce blocks of a maximum size of 18in. by 9in. by 4½in. thick, and, of course, any size of block or blocks within those dimensions. Two mould boxes are employed, so that while one box is having its finished block removed and being again re-filled, the other box can be under the press. The action of the machine is, therefore, practically continuous.

The construction of the mould box is quite simple. There is first of all the carriage, which is furnished with four running wheels and which is formed in one piece with the vertical back wall of the mould. To the latter are hinged, one at each end, the end walls. The front wall is hinged to the front of the carriage. The mould is, when closed, held securely by means of two cam-shaped catches, which are hinged to the end walls and engage in slotted lugs formed on the front wall. The press head can be arranged to make plain, rock or chisel faced blocks, and tongued liners can also be used in the moulds for making interlocking blocks. In order that the mould may always be brought into the exactly correct position immediately below the press head, there is fitted in the upright which carries the gearing, a spring-controlled plunger, which is arranged horizontally and the round end of which normally projects so that it may enter a circular depression formed in the rear wall of the mould box. As the mould box is pushed under the press head the plunger is first of all pushed backwards, but when the depression is reached, it is forced forward by its spring and enters the depression, thus showing the attendant that the mould box is correctly placed for the pressing operation. The spring controlling the plunger is neither so strong nor is the depression in the back wall of the mould box so deep that there is any difficulty in pushing the box sideways when pressing is completed.

The pressing mechanism is interesting. It is hand-operated and not laborious to work. In fact, we are informed that, as often as not, it is a boy who turns the hand wheel. The latter is fairly stout in construction, so that it may act as a fly-wheel to take

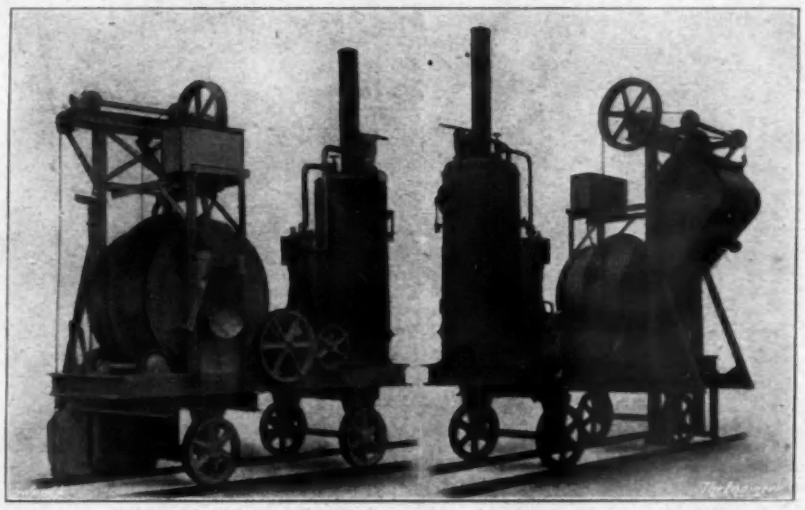


FIG. 5—THE "ZENITH" CONCRETE MIXING MACHINE—BRITISH STEEL PILING CO.

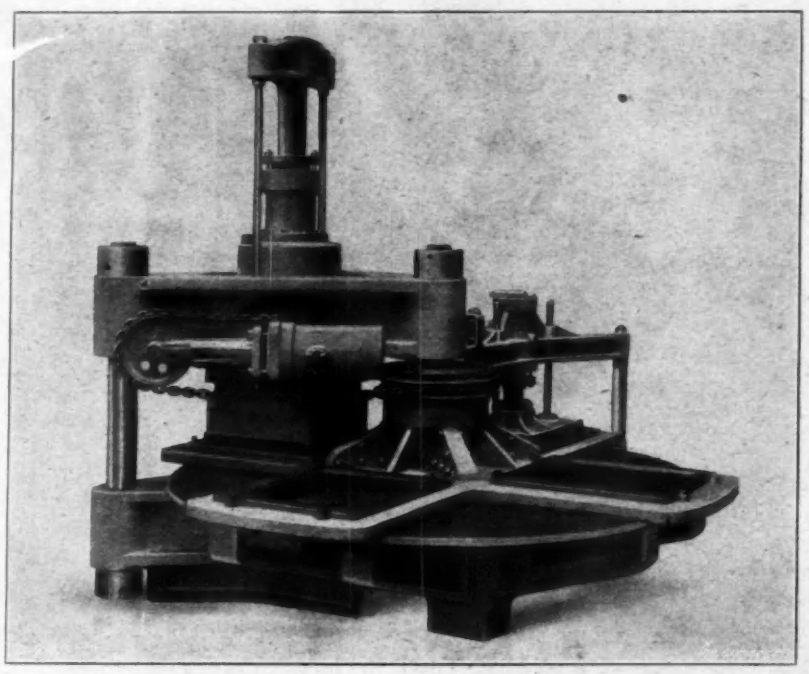


FIG. 4—CONCRETE SLAB-MAKING MACHINE—H. BERRY AND CO.

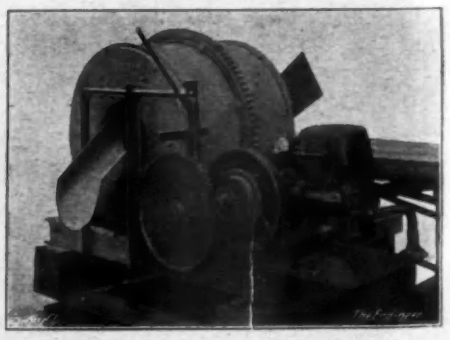


FIG. 6—THE "ZENITH PUP" CONCRETE MIXER

the press over dead centre. The speed of the hand wheel shaft is reduced either by worm or spur gearing, the reduction being about 5 to 1. The second motion shaft, which is carried in two bearings, has mounted on the end which is remote from the gear wheel an excentric, the strap on which actuates a flexible pressing rod, which is hinged to the press plate, the flexibility being obtained by means of two strong coiled springs. That the motion of the press plate shall be truly vertical is ensured by two guide rods, formed in one with the plate, which work in cast iron brackets fixed to the main casting.

The process of block making is exceedingly simple. The mould box with a wooden or cast iron pallet of the correct size placed on its bottom plate is closed and tightly locked. The aggregate is then shovelled into the mould without any tamping, and one of the operators roughly strikes off the top surface level with the top of the mould box. The latter is then pushed under the press plate and brought into correct position as explained above. The hand wheel is then revolved until the press plate has descended into and been withdrawn from the mould box, the direction of turning the wheel being always in the same sense. The block is then formed, and when the mould box is pushed from under the press head and opened up, it may be lifted away on its pallet by one operator and put aside to harden and season. Meanwhile the other mould box is being filled and the second block pressed, and so on.

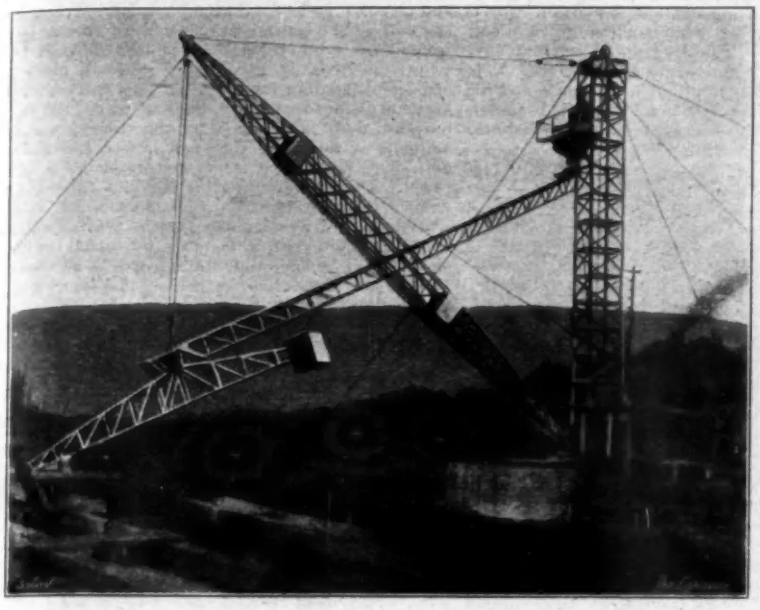
Among the other claims made for the machine are that it does not require skilled labour to work it, that it is fool-proof, and that no scooping out of the mould is necessary.

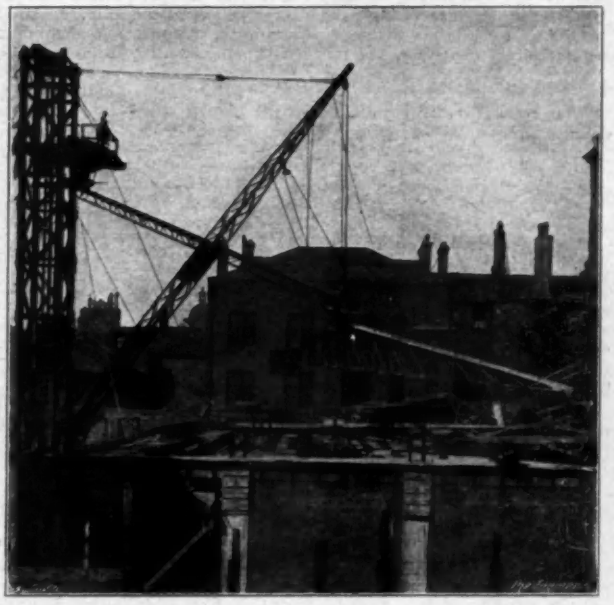
Henry Berry and Co., Limited.

A powerful hydraulically operated press for making concrete slabs or flags, varying in size from 2ft. by 2ft. up to 3ft. by 2ft. 6in. and 2½in. thick, is made by Henry Berry and Co., Limited, of Croydon Works, Leeds. With it from forty to fifty flags can, it is stated, be made in the hour as a general average, and we gather that the machine has actually produced as many as sixty per hour under service conditions. The construction and working of the press will be readily understood from the half-tone engraving—Fig. 4. There is a fixed circular horizontal table, which is carried partly on the underframe and partly by cast iron brackets bolted to the latter. Arranged to revolve immediately above the circular table is the mould-carrying member, which is made in the form of a cross. Each arm of the cross has a rectangular hole in it, which is larger than the largest slab for which the machine is intended. Into these holes the mould frames, the inside top edges of which are chamfered, are dropped and secured in position by means of bolts.

In operation, each mould has first of all dropped into it a flat smooth plate or pallet, which just loosely fits the mould and lies on the fixed circular table. Working begins with the mould shown on the right hand of the illustration. The mould is first roughly filled with concrete. The mould-carrying cross is then moved through one-quarter of a revolution by means of the small horizontal hydraulic cylinder—seen in the front of the machine—and of a chain, one end of which is attached to the body of the cylinder and the other to a grooved horizontal wheel arranged to slide up and down and to revolve on the same vertical post as does the cruciform mould-carrying table. The underside of the wheel is furnished with four ratchet teeth, spaced at equal intervals and so shaped as to fit into and engage with corresponding teeth formed on a boss mounted on brackets which are attached to the mould carrier. One stroke of the cylinder turns the mould carrier through exactly one-quarter of a revolution. A corresponding cylinder on the other side of the machine then revolves the grooved chain wheel backwards to the same extent as the first cylinder had moved it forward—without, of course, moving the mould carrier, because of the ratchet form of the teeth—and a further stroke of the first cylinder then revolves the mould carrier through another quarter revolution and so on.

After the first quarter turn the mould, which was, first of all, on the right-hand side, comes to the front of the machine. The surface of the concrete is then levelled with a striking iron or trowel and the carrier revolved through another quarter turn, so that the mould is brought directly under the main vertical compressing ram, the plate attached to the bottom of which is just capable of entering the mould. Hydraulic pressure is then applied, first of all at 500 lb. per square inch and then, by means of an intensifier, at 3500 lb. per square inch, the result being that the concrete material is much consolidated, the surplus water is squeezed out, and the surface of the slab is made quite smooth and level. When the ram is withdrawn a further quarter turn of the mould carrier brings the pressed slab immediately under a smaller





FIGS. 7 AND 8—EXAMPLES OF CONCRETE DISTRIBUTING PLANTS—THE BRITISH STEEL PILING, CO.

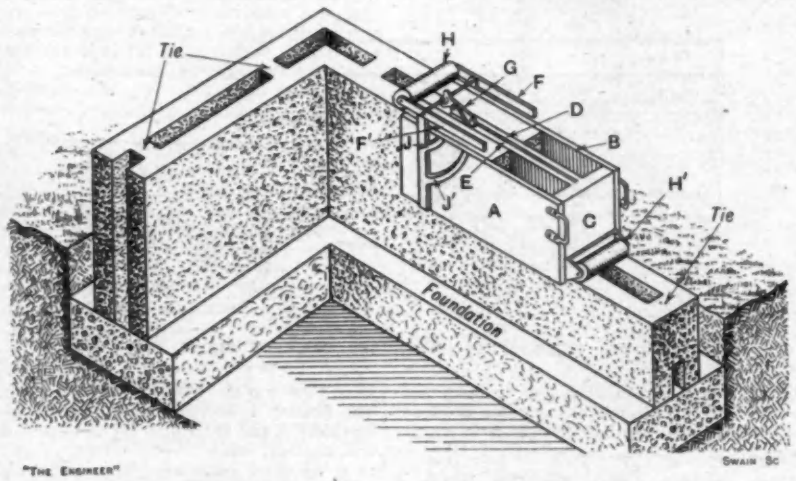


FIG. 9—THE "C.D.L." CONCRETE BUILDING DEVICE—CONCRETE DWELLINGS, LIMITED

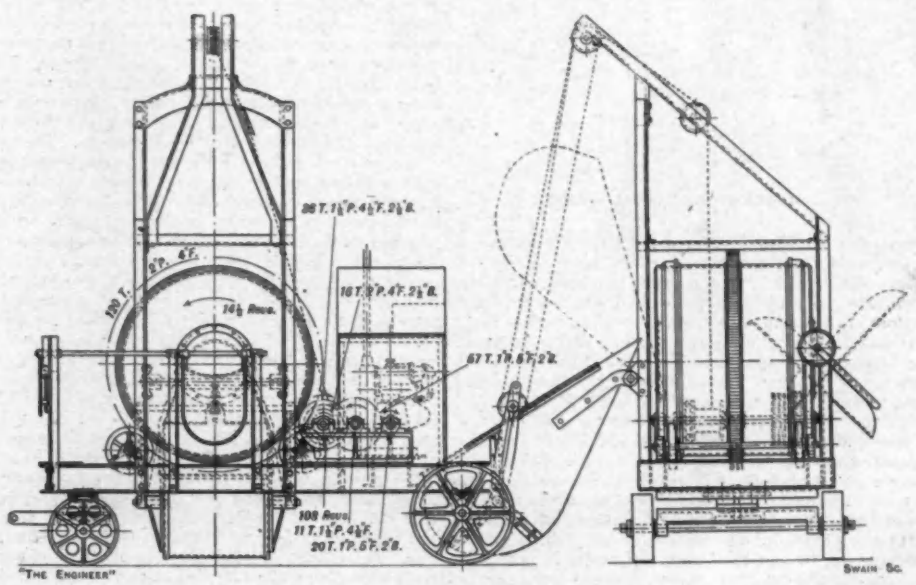


FIG. 10—PARALLEL-DRUM CONCRETE MIXER—WILLIAM JOHNSON AND SONS

vertical ram and over a hole formed in the fixed circular table through which the slab and its pallet are forced by the ram on to a trolley waiting beneath. Four men or boys are used to operate the machine, and all the operations we have referred to are proceeded with simultaneously. The total weight of the machine with the necessary hydraulic pumps, accumulator, intensifier, &c., is given as being 32 tons.

THE BRITISH STEEL PILING COMPANY.

The concrete mixers made by the British Steel Piling Company, of Dock House, Billiter-street, E.C. 3, have been named the "Zenith." They are made in four sizes, with average outputs per ten-hour day of mixed concrete varying from 75 cubic yards in the smallest size to 300 cubic yards in the largest. There is also a smaller-sized machine known as the "Zenith Pup," which has been designed to meet the special needs of smaller contractors and builders. As a matter of fact, the "youngster" is not so very tiny after all, as it is capable, so we understand, of turning out some 37½ cubic yards of mixed concrete per ten-hour day. As typical of the company's larger plant, we illustrate in Fig. 5 a ¾-yard machine, the stated output of which is 225 cubic yards per ten-hour day. The mixing drum is of the revolving non-tipping type and is furnished with interior wings of distinctive shape. On the side of the drum at which the materials to be mixed are put in is fitted a series of shovel wings, which are designed to pass the material across the drum in an inclined direction and, at the same time, to turn it over on itself. The material is delivered from the shovel wings into a series of lifting wings, which, as the drum revolves, carry the aggregate up and then pour it down towards the bottom of the drum. The makers explain that as these actions take place simultaneously in a revolving drum the streams of material issuing and falling from the two types of wings are so thoroughly intermingled that perfect mixing is accomplished. It is claimed that the folding-over motion of the material by means of the shovel wings is a feature not found in other mixers, and that it results in the material being very largely mixed before it is lifted at all, so that the output in mixed concrete is large, while the running costs are low. Spilling and splashing of material from the drum, in the opinion of the company, are mainly due to the fact that the drum is not large enough for the charge it is specified to carry. Hence it makes its drums large—larger, it is claimed, for a given batch capacity than any other mixer on the market. The drum is provided with two tire rings, one at each end, which run on four bearing wheels, and it is revolved by means of the central toothed gear ring.

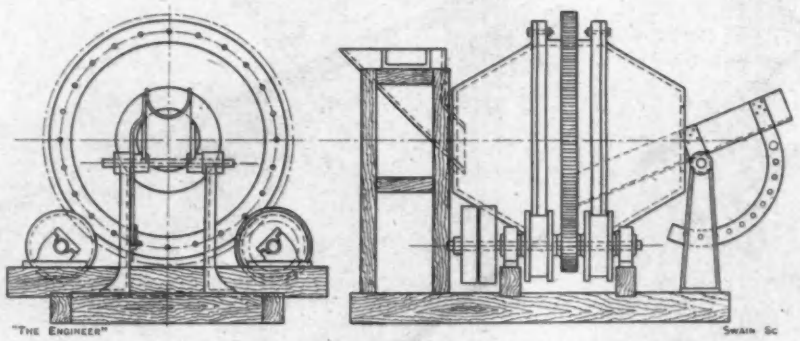


FIG. 11—DOUBLE CONE-ENDED DRUM CONCRETE MIXER—WILLIAM JOHNSON AND SONS

A fixed feed hopper is supplied for use in cases in which it is convenient for the unmixed materials to be brought to a position above the mixer drum, but for cases in which the aggregate is brought to the ground level side loaders are fitted as in the illustration Fig. 5. In the plant illustrated the drum has a capacity of 24 cubic feet, while the loading skip can take in 27 cubic feet. The drum itself, we may say, measures 5ft. 3in. in diameter by 4ft. in width. It is designed to run at 15 revolutions per minute, and for its full output an engine of 10 horse-power is required. The mixed concrete is discharged by means of a shoot, which is operated by a hand lever and which can be swung up out of the way while mixing is going on, only being lowered for the discharge.

Fixed well above the drum is a water tank, which is so arranged that a given quantity of water can be delivered into the drum with each batch that is mixed.

As seen in the engraving, the whole plant—comprising boiler, engine, mixer, and loading skip—is carried on a base on four flanged wheels for use on railway lines. For use in other places ordinary flat-faced wheels are supplied, and in that case the front axle is made to swivel so that the plant is readily moved from place to place.

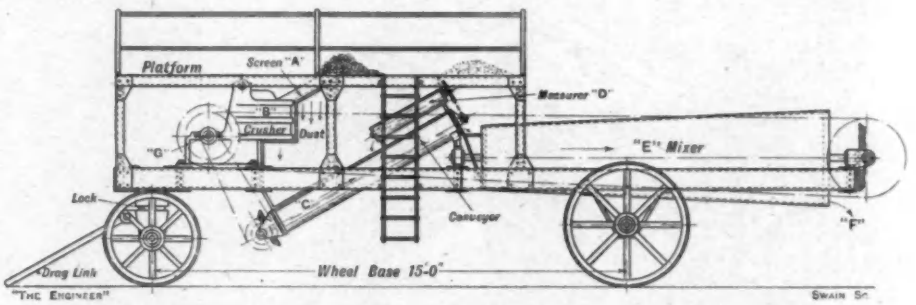


FIG. 12—COMBINED CRUSHING, MEASURING, AND CONCRETE MIXING PLANT—JOHNSON

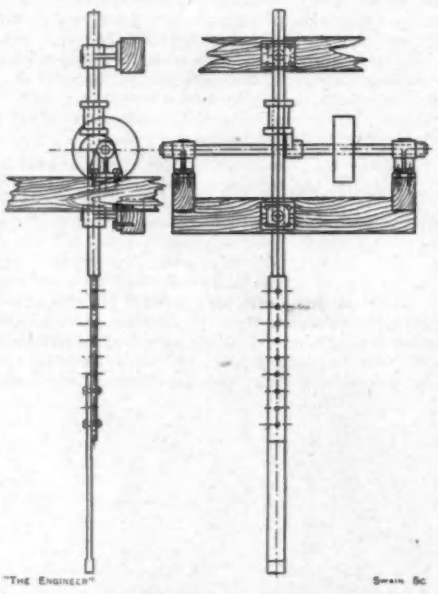


FIG. 13—JOHNSON MECHANICAL TAMPER

The small "Zenith Pup" machine, which is illustrated in Fig. 6, is the latest machine which the firm has introduced. It is practically a replica on a smaller scale of the machines which have been described in the foregoing, and is, we understand, being manufactured on "mass production" lines, every part of it being interchangeable. The drum has a capacity of one eighth of a cubic yard and it can turn out thirty batches per hour. The standard drive is by means of a small petrol engine which is mounted on the same base as the mixer, thus forming a self-contained plant. There is a platform on which sloping planks may rest, so that the materials to be mixed may be wheeled up in barrows and tipped into the drum through the fixed feeding chute. The mixed concrete is discharged by a hand-operated chute at such a height that it can be delivered into barrows. In its standard form the plant is intended to be fixed in one position as shown in our engraving, but road wheels can be fitted if required. The total weight of the plant, including the engine, is about 17 cwt.

The British Steel Piling Company was among the first firms—if indeed it was not actually the first—to manufacture and sell concrete spouting or placing plants in this country. The first actually built was supplied to the Admiralty for the construction of the oil fuel depôt at Old Kilpatrick. Subsequently quite a number has been built for various works. We illustrate two of them in Figs. 7 and 8. It will be seen that in general principles the two plants are very much alike. In one case, however, the tower is of wood and in the other of lattice steel work. The plant illustrated in the left-hand view was designed and constructed for Morrison and Mason, Limited, the contractors for the Forth to the Clyde fuel pipe line. It includes a "Zenith" concrete mixer fitted with a mechanically operated side loader. The mixed concrete is delivered into a skip at the bottom of the steel tower, which is 72ft. high. The skip can be elevated inside the tower by a winch—also made by the company—and its contents discharged into a fixed hopper, from which it drops into the first trough chute, which is 72ft. long and which is formed on the upper side of a steel lattice girder. When it has reached the end of the first trough the concrete falls through a hopper into a second trough, which is carried on a cantilever girder 32ft. long, one end of which is provided with a balance box so that girder and trough may be fixed at any required angle. From the end of the second trough a third trough is suspended by a universal joint, which allows it to be swung horizontally through a complete circle and also gives freedom for any necessary movement in a vertical plane to suit any angle at which the trough may be used. The weight of the troughs and their contents is taken by the steel lattice jib, which is 80ft. long and which is pivoted at the base of the tower. The maximum radius at which the plant will deliver concrete is 82ft. The plant which is illustrated in the right-hand engraving was supplied to Messrs. Robert Thorburn and Co. for use on the extension to the Union Cold Storage Depôt at Glasgow. We may add that among other plants which the firm makes is a ballast washer, which is manufactured under Pleasance's patent and which has a capacity of 20 cubic yards of washed material per hour. The plant not only washes the ballast, but grades it as well, the sand being separated from the larger particles.

CONCRETE DWELLINGS (PARENT COMPANY), LIMITED.

What is known as the C.D.L. system of concrete construction is effected by means of an apparatus which has been introduced by Concrete Dwellings (Parent Company), Limited, the offices of which are at 1, Carteret-street, Westminster, S.W. 1. The idea is simplicity itself, but we have been informed by builders of experience who have employed it that the device performs the work for which it was designed exceedingly well. Explained briefly, it is a box with no top, no bottom, and without one of its ends. The two sides are hinged to the remaining end and to the centre of the latter are also hinged close together two parallel pieces or tongues of wood, which divide the width of the box into two equal parts. It is shown diagrammatically, as employed in practice, in Fig. 9. The two sides A and B are hinged to the end piece C, as are also the two parallel tongues D and E. The hinging is so effected that, if uncontrolled, the two sides A and B tend to spring outwards away from one another, while the two tongues D and E tend to come closer together. The effect of pressing the two levers F and F¹ downwards from a horizontal to a vertical position is to make the two sides A and B and the tongues D and E all absolutely parallel to one another. The levers F and F¹ in their travel press on the slides J and J¹, which are of increasing thickness, so that when F and F¹ are vertical the sides A and B are parallel. The motion of the levers also actuates a device G, which pushes the two tongues D and E apart, so that when the levers are vertical the two sides of E and D are also parallel. The net result is the formation of two parallel mould boxes with a space between them.

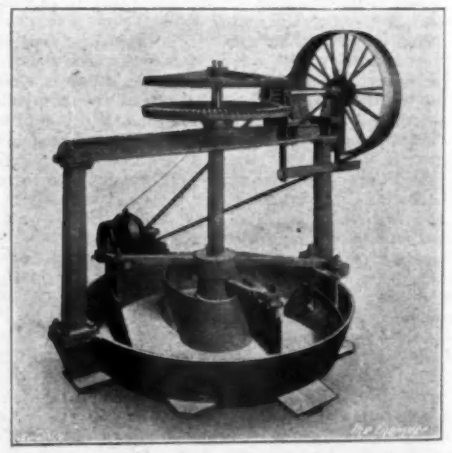


FIG. 14—DOUBLE-MOTION CONCRETE MIXER—KIRK & CO.

With the foregoing description the action of the device will be readily understood. As shown in the

illustration, a length of double wall with a cavity in the centre of its thickness has just been formed. The bringing of the levers F and F¹ into the horizontal position has allowed the sides A and B to spring slightly apart and the tongues D and E to come closer together. There is, hence, no longer contact between the concrete and the walls of the moulds, so that the apparatus can be pulled away by means of the two handles, the two rollers H and H¹ facilitating the process. When pulled sufficiently far, the builder, after satisfying himself that the mould is vertical by laying a spirit level on the top of the sides A and B, clamps the device by depressing the levers and a further length of concrete work can be poured and tamped. The apparatus can be made to form ties in concrete between the outer and inner walls at the same time as forming the walls themselves, but metal ties can, if desired, be employed.

A number of claims are made for the C.D.L. machine. First, that it is simple, strongly built, and easily handled; secondly, that the expanding and contracting core permits of the utmost accuracy in construction since the walls and tongues do not touch the moulded concrete as it is drawn away from it; thirdly, that the machine can be unclamped, moved along to the next position, levelled and clamped up again in 30 sec.; fourthly, that no method of movable shuttering can compete with it in speed, and that skilled labour is not required to operate it; fifthly, that the machine constructs a monolithic wall in one operation, and the concrete matures in position, so that there is no stacking weeks before it is built into the building, and that hence the system makes for speed and economy of construction.

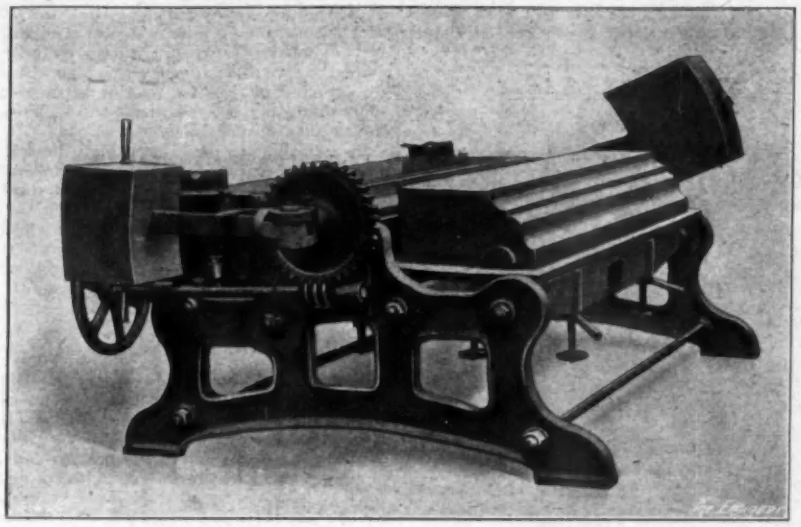


FIG. 15—GENERAL PURPOSE CONCRETE BLOCK-MAKING MACHINE—KIRK AND CO.

Wm. Johnson and Sons (Leeds), Limited.

In addition to being among the oldest makers of cement manufacturing machinery in this country, Wm. Johnson and Sons (Leeds), Limited, of Castleton Foundry, Armley, Leeds, were early in the field with appliances for mixing and using concrete. It would be impossible in the space at our disposal to deal in detail with all the machines which they have designed and constructed for those purposes, and we must confine our attention to illustrating and describing what may be considered a typical selection of them

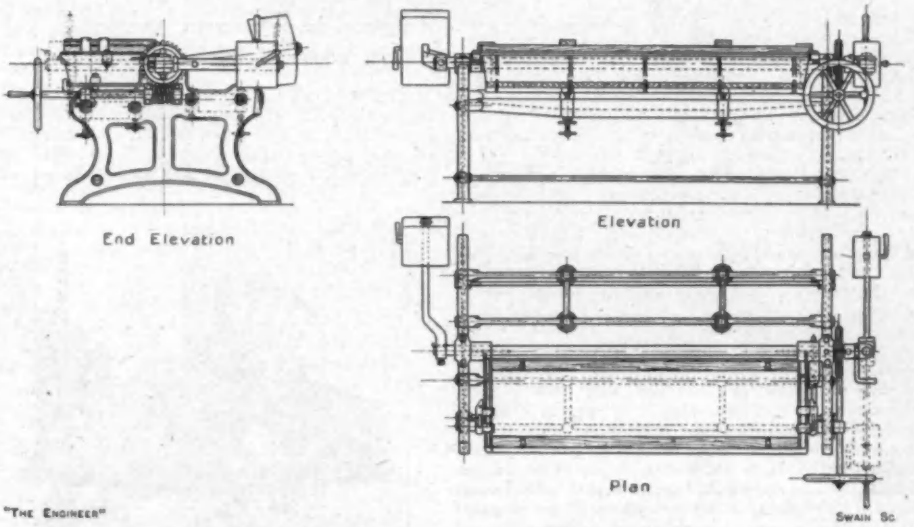


FIG. 16—ARRANGEMENT OF KIRK BLOCK-MAKING MACHINE

In the first place, we would draw attention to the self-contained mixing plant illustrated in Fig. 10. As shown, the machine is driven by an internal combustion engine, but a steam engine or electric drive is supplied if required. The mixer proper consists of a mild steel barrel with dished ends, the whole being riveted together. Inside the barrel are fitted mild steel plate lifters of a design which Messrs. Johnson have found to give the most efficient and thorough mixing of the ingredients in the shortest possible time. The outer periphery of the barrel is fitted with two machined bearing tires and a toothed gear ring. The barrel is supported on friction rollers on which the tires rest, the rollers being carried on mild steel shafts. The rotary motion of the barrel is obtained by means of a train of gearing. Running loose on the third motion shaft, but furnished with a clutch and brake, is a cast iron barrel, which is used for hoisting the loading skip, the operation of which will be readily understood. The skip in its lowest position is arranged near the ground, so that it can be filled with a minimum of manual labour.

Delivery of the mixed materials is obtained by means of a swivelling chute fitted at the other or discharge side of the barrel, and it is controlled by a lever having a locking rod and quadrant. Whilst the concrete is being mixed the swivel discharge chute is left in the position as shown by the dotted lines, and inclines inwards so as to assist in the mixing of the materials.

The whole apparatus is mounted upon a mild steel frame, which is provided either with road wheels of a width suitable for negotiating soft ground, or with flanged wheels for railway work. The water required for mixing with the cement and aggregate is contained in a circular tank, which is supported upon the framework and is provided with a large outlet pipe and control valve, the water pipe entering the rotating drum in a position close to the discharge and of the loading skip. The water tank is graduated on the outside so as to show the contents in gallons and half-gallons. The attendant is thus able to decide accurately the quantity of water discharged, a float in the tank operating a rising and falling gauge. The inlet to the tank is by means of a ball valve having a large orifice so that the tank is constantly and quickly replenished from the water supply. The machine is made in various sizes, for dealing with ½, ¾, 1, 1½ or 2 cubic yards of mixed concrete per batch.

A machine of a slightly different type which has been particularly designed by Messrs. Johnson for use in small contracts is shown in Fig. 11. It consists of a cast iron double conical barrel provided in the centre with a ring of gear. The flanges, which are used for bolting the three parts of the barrel together, also form the races for supporting the barrel on friction rollers. The motion is obtained by means of a countershaft provided with fast and loose pulleys through a spur pinion to the ring of gear, but the weight of the barrel is carried by the friction rollers shown. Delivery of the mixed concrete is effected by means of a swivel chute fitted with a quadrant and locking pin so that the mixed material can be discharged into barrows or wagons. This

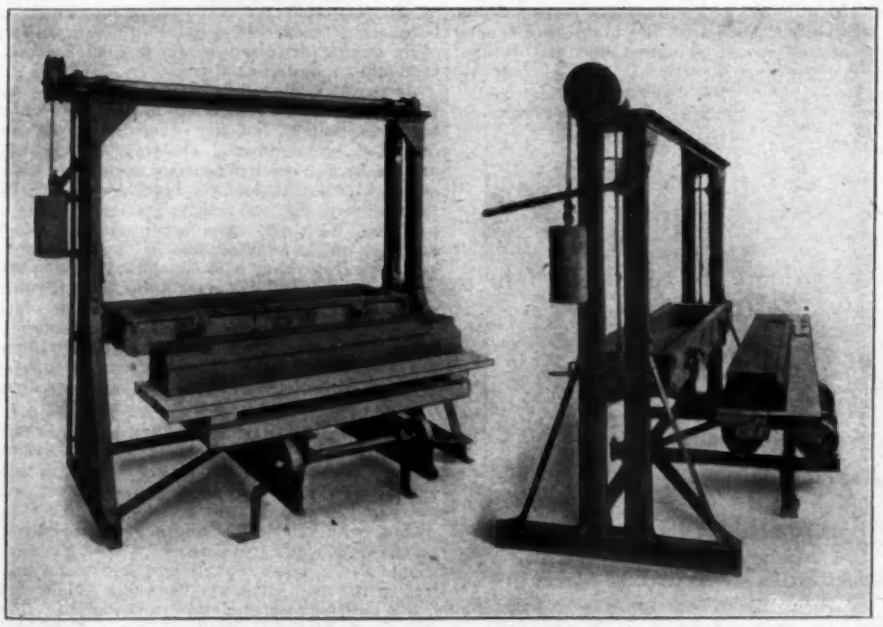


FIG. 17—GENERAL PURPOSE CONCRETE BLOCK-MAKING MACHINE—THE LINER CO.

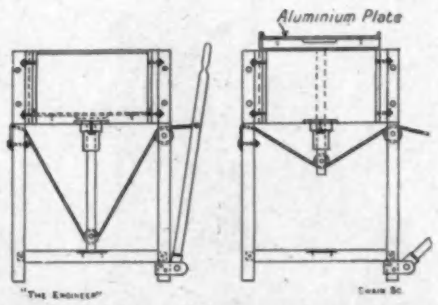


FIG. 18—MANELITE HAND-WORKED BLOCK MACHINE

machine is made for dealing with from 5 to 10 cubic feet of material at a time.

An entirely different type of machine is shown in Fig. 12. It is a combined portable crushing, measuring and mixing plant, which was designed by one of the firm's directors whilst on service with the British Expeditionary Force. It was originally intended to take the rubble in the destroyed villages and towns, crush where necessary, and mix with cement for the manufacture of concrete.

The method of working is as follows:—The plant is drawn alongside a destroyed house or rubble heap, and the rubble is delivered on to the platform by means of barrows up a plankway. The cement is delivered on to the platform in sacks, one man only being required on the platform to feed the materials. The rubble is fed over screen A, which separates the dust from the large pieces, the former dropping down the dust hopper into conveyor C, the latter rolling over the screen to be crushed by crusher B, and meeting the dust in conveyor C. The two materials are then conveyed up till they meet the cement delivered from measurer D. A measuring arrangement for proportioning the amount of dust to the amount of rubble so as to form a correct aggregate is also fitted. It is contained in the dust hopper underneath the screen A, the measured dust falling into the conveyor C. The cement sacks are emptied into the hopper over the measuring conveyor D, and the relative speeds of the two shafts of C and D give the proper proportions of cement and aggregate. The mingled materials are then delivered into revolving a concrete mixer E, which is provided with a water spray regulated to give the correct amount of water so that at point F the concrete is delivered into barrows or other suitable receptacle mixed and ready for use. The whole plant is driven from one belt at G or other means of power, and the several items of the plant itself are driven by belts from the shaft G. One man only is, it is said, necessary for the whole process. This plant is made in one size only, namely, for an output of 4 tons of finished concrete per hour. It is furnished with a drag link for haulage purposes.

The firm also makes other types of mixers, including one of box form, which is fitted with two shafts and shovel action paddles.

Another of Messrs. Johnson's machines is a mechanical tamper. It comprises a countershaft supported in bearings upon overhead beams and driven by a fast pulley. On the countershaft is keyed a cam which engages a tappet fixed to the upright stem of the tamper. The stem, which is of mild steel, is guided in its up and down motion by bearings which are also attached to the overhead beams. The bottom part of the stem is flattened and provided with a number of holes, and to it is fastened the tamp head, which is also provided with a number of corresponding holes, so that the position of the tamp head can be raised or lowered, as may be desired, when the operator is working either at the bottom of the mould or towards the top. The mould is usually placed upon a smooth surface, such as the top of a bogie wagon, and is moved about as required to bring the tamp head in the desired position. The tamper is shown in Fig. 13.

Messrs. Johnsons, among other appliances for use with concrete, make steel moulds for forming concrete pipes. The mould consists of steel inner and outer cylinders of the diameter for the size of pipe required, and it may be either of a circular or oval section. The outer cylinder is made in halves, which are hinged at the back and provided with a locking device at the front, the inner cylinder being bent from one plate with a close fitting joint. A cast iron ring is fitted at the bottom between the two cylinders, and is shaped to give a socket end of the pipe. These moulds are supplied in sizes for making pipes of 4in. up to 36in. diameter, and, as mentioned above, may be of a circular or oval shape.

In addition to the foregoing, Messrs. Johnson manufacture various machines for making concrete bricks and slabs; a plant to wash sand for concrete making, &c., and also a shaking table for the purpose of agitating moulds or forms whilst they are being filled with concrete so as to liberate the air and ensure a more solid cast. They are also prepared to make chutes for distributing concrete to suit particular sets of conditions.

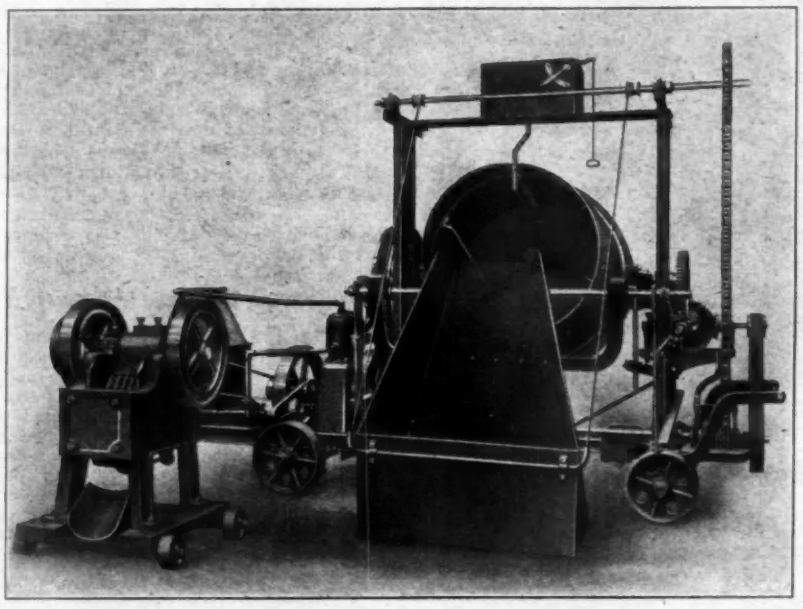


FIG. 19—"THE IDEAL," CONCRETE MIXER—FREDERICK PARKER

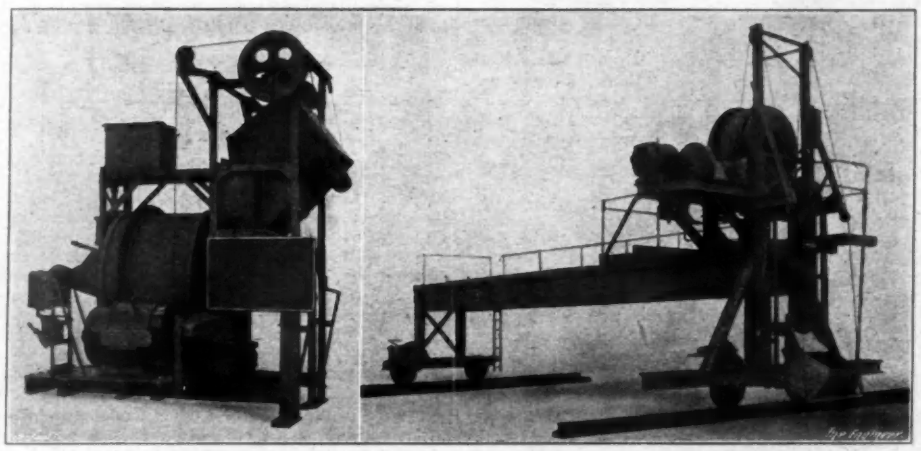


FIG. 20—MOTOR-DRIVEN MIXER—RANSOME

FIG. 21—RANSOME MIXER ON TRAVELLING GANTRY

FIG. 22—RANSOME MIXER FOR HARBOUR WORK

FIG. 23—RANSOME MIXER ARRANGED IN CRANE LEG

R. H. KIRK AND CO.

A horizontal pan concrete mixer for which several special claims are put forward is shown in Fig. 14. It is made by R. H. Kirk and Co., of Collingwood House, St. Peters, Newcastle-on-Tyne, who call it a double-motion mixer. In the pan are four blades or ploughs, two of which revolve in one direction round the inside edge of the pan, while the other two revolve in the other direction round a central truncated cone-shaped boss in the centre. The shape and position of the ploughs is such that all the whole area of the pan is swept over, and it is claimed that, not only are the ingredients turned over four times during every single revolution of the ploughs, but that the materials do not ball, while the larger aggregate is not separated from the small. The makers explain that the mixing ploughs do not aimlessly push the materials round the mixing pan, but that they turn the contents of the pan over and over with such regularity that perfectly mixed concrete is obtained. It is also stated that, since the ploughs revolve in opposite directions, a balanced effect, which reduces working depreciation to a minimum, is obtained. The double motion of the ploughs is also said to do away with the necessity for washing the mixing pan several times a day, since it mechanically cleanses itself when discharging the batch. The discharge of the mixed materials, it may be explained, is effected by a sliding door in the bottom of the mixing pan, the discharge of a batch taking less than half a minute.

As shown in the illustration, the mixer is driven by a small electric motor and is furnished with fast and loose pulleys, but any other form of drive can, of course, be employed. The time required to mix and discharge a batch of concrete is some two minutes, and it is stated that thirty batches can actually be obtained with it in one hour.

Messrs. Kirk also manufacture the block-making machine which is illustrated in Figs. 15 and 16, and they claim that it is capable of making all the artificial stone and concrete blocks, &c., required in a building from the foundation to the chimney cornice. The machine as shown has just moulded a gutter cornice, and with the standard accessories it can produce any stone with dimensions up to 5ft. long by 16in. wide by 9in. deep—or, say, of a total of 5 cubic feet—in one operation.

In the engraving the mould box is seen at the left rear. In making a block or blocks—for more than one can, of course, be made at one operation by the employment of division pieces—the makers' instructions are that the first thing to be seen to is that the pivotal balance is on the same side of the shaft as the moulding box and is secured by a spring clip. Care should also be taken that the end liners point the long way of the mould. A wooden pallet should then be put in position on the mould—as though it were a cap or cover—and held in place by means of the clips provided. The mould should then be turned over through 180 deg. by means of the hand worm and worm wheel in order to make sure that the height of the receiving table is correctly adjusted, by means of the adjusting screws and lock-nuts, so as to be exactly at the right height to receive the finished

stone. Then, having returned the mould box to its original position, the pallet is removed, and any necessary weatherings arranged in the former. The mould is then half filled with aggregate, which is carefully tamped by hand or by machine so as to get it well into the corners. More aggregate is then added and the tamping continued until the mould is more than full. The surplus aggregate is then struck off with a steel-lined float and the surface is trowelled with wet mixture. Then, if there are division plates, they should be removed. The pallet board should then be placed on the top of the mould box and secured. Then, after having swung the pivotal weight to the opposite side of the shaft, that is, opposite the mould, the hand wheel is worked so as to turn the mould over. The weight is then again reversed so that it is on the same side as the mould, and the clips drawn clear of the pallet. The mould is then turned back to its original position, leaving the block or stone resting on its pallet on the receiving table ready to be removed, a process which can be effected by two men.

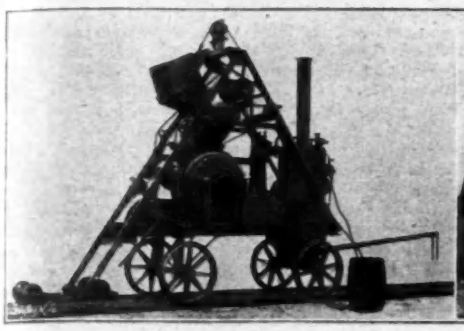


FIG. 24—OLD TYPE RANSOME MIXER

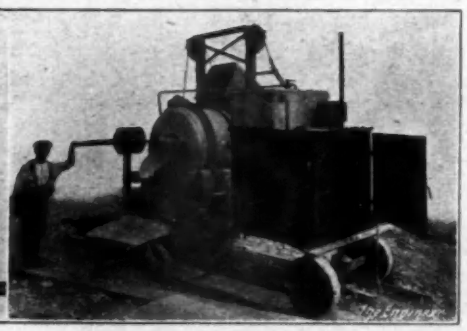


FIG. 25—RANSOME MIXER FOR STREET WORK

As amplifying what has been said above concerning the range of products of which the machine is capable we may say that with it can be made, among a host of other things, window heads, sills, steps, coping, partition slabs, gutter cornices, water-tabling, string courses, bases, jambs, mantels, lintels, ashlar, fence posts, single and double plain and rock-faced blocks, &c., according to the liners employed in the mould.

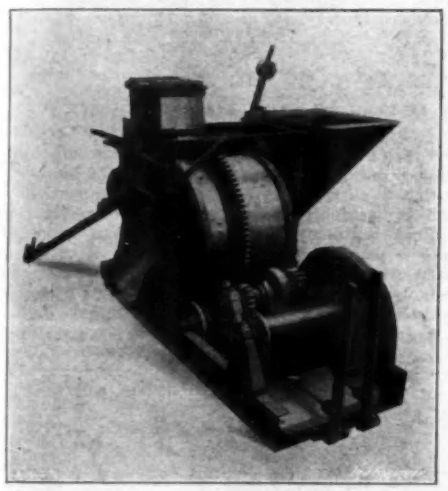


FIG. 26—MIXER WITH HOISTING GEAR—RANSOME

For tamping Messrs. Kirk have devised a special machine, with which a 5ft. sill can be tamped in less than two minutes, during which time, so claim the makers, a harder "stone" will have been made than would be obtained by two men after hand tamping for a quarter of an hour, so that not only are workmen relieved of unnecessarily hard work, but manufacturing charges are reduced.

Before passing on we may add that among the other machines made by Messrs. Kirk is a self-balancing rotary washer and machine for treating the gravel or other aggregates used in the manufacture of concrete blocks, &c.

THE LINER CONCRETE MACHINERY COMPANY.

The illustration given in Fig. 17 shows the latest concrete machine made by the Liner Concrete Machinery Company, of Newcastle-on-Tyne. The full title given to it is the "L.C. patented concrete slab, block, lintel, head and sill machine." It is, as will be seen, built up of angles, channels and bars. The moulding box, which is of machined cast iron, is made to move up and down the slides formed by the vertical channels and the balance weight is only slightly lighter than the box, so that only very small pressure is needed to pull the latter up. When pressure is taken off the weight, the box automatically slides down into the proper filling position.

The machine has been designed to make every stone required in the construction of houses, such as rock-faced or plain building blocks, quoins, gate piers, double rock-faced blocks for boundary walls, breeze blocks for partition walls, steps, sills, heads, mullions, moulded stringing, gutter cornice, water-tabling, chimney stones, jambs, mantels, moulded coping, half-round coping, garden edging, flags, &c.

The operation is simple. The mould box, after having placed in it the linings necessary to produce the particular type or shape of block being made, is partially filled with semi-dry concrete, and the latter is then beaten with a hand tamper. More concrete is then added and tamped down, and then more till the mould is rather more than full. The surplus is then struck off and a wooden pallet arranged on the top of the mould and secured in position by means of clamps pivoted to the mould box. A pin, which holds the box in a horizontal position, is then removed, and the mould turned upside down so that the pallet is facing downwards. The four-wheeled bogie is then run immediately beneath it, the clamps are undone, and the mould box is raised clear of the block or blocks by pressing on the lever controlling the counterweight. The moulded stone, or stones, as the case may be, are then resting on the pallet on the bogie, and when the latter is pulled from beneath the mould, it or they may be carried away to the drying ground.

The firm also makes an elevating bogie for use instead of the bogie or truck, so that the blocks can be received on it and wheeled away, but it is not regarded as a necessary adjunct, since the blocks are of such a size that they can be handled by labourers. The particular machine illustrated can make lintels up to 6ft. long by 13in. wide and 6¾in. deep. Recent improvements have been introduced, by which twelve slabs, 2ft. long by 10in. high by 3in. wide, or four kerbs, 3ft. long by 10in. high by 6¾in. wide, can be made in one operation and on one board. A very large variety of other shapes and sizes can, of course, be made by the aid of the requisite fittings.

The following claims are made for it by its manufacturers:—(*a*) That it is portable and fool-proof; (*b*) that there are no wheels to turn or to get out of order or weights to move or springs and levers to pull; (*c*) that when the holding pin is removed, the mould turns over; (*d*) that the mould box is in one piece; (*e*) that inexperienced labour only is required; and (*f*) that the machine, being portable, stones can be made on the actual site in which they are to be used.

We may add that the Liner Company makes the Harrison patented washer for washing all kinds of materials.

MANELITE PATENT CONCRETE MACHINERY CO., LTD.

Two types of concrete block-making machine are manufactured by the Manelite Patent Concrete Machinery Company, Limited, of Petra-place, Poole-hill, Bournemouth West. One is a hand machine, while the other is operated hydraulically. The principle of the hand-operated machine is shown in Fig. 18. Any size of block up to 18in. by 9in. by 4in. thick can be produced. The block is moulded on its edge. The aggregate, after having been fed into the mould box and tamped in layers by hand, is struck off level with the top of the mould. The lever is then depressed and the block thrust out of the mould by the rising of the vertical plunger. It, and its pallet board, which at the commencement of operations rested on the aluminium plate—then at the bottom of the mould—can be lifted away. The machine is fitted with a table, the surface of which is level with the top of the mould, for carrying the aggregate. Slabs and other articles besides plain blocks can be made in the machine, and the slabs, &c., can be made interlocking.

The hydraulically operated machine is similar to the foregoing, in that the blocks are moulded on edge, but it differs from it in several respects. In the first place, it has a spring-controlled hinged cover, which can be folded down and secured over the orifice at the top of the mould. The operations of making a block are as follows. A wood pallet is first of all dropped into the mould. Stress is laid by the makers on the fact that no expensive metal pallets are necessary

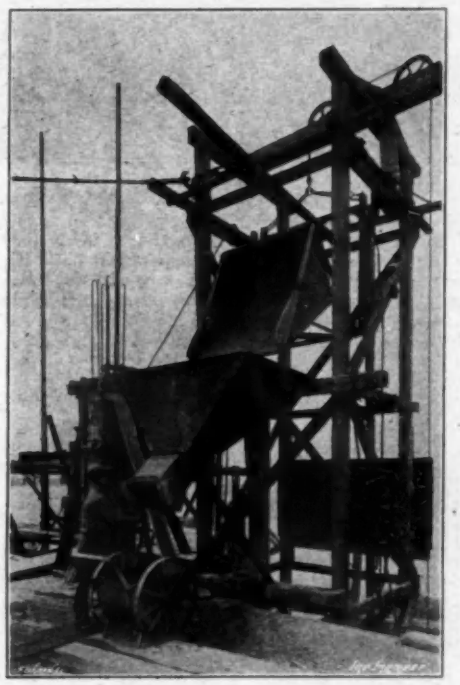


FIG. 28—SELF-TIPPING HOIST BUCKET—RANSOME

only pieces of wood made to fit the mould are required Aggregate is then lightly shovelled into the mould without any tamping, till the latter is full. The surplus material is then struck off and a special pallet board is inserted into the top of the mould and pressed down by hand until it is level with the top edges of the side plates. The cover is then hinged down over the top of the mould and secured in position. Hydraulic pressure is then supplied to the ram of an hydraulic cylinder arranged vertically below the mould much in the same way as is the plunger of the hand machine. The effect of turning on the pressure is first of all to compress the block, then to release the cover, which opens under the action of its spring smartly, and finally to push the block out of the mould so that it can be lifted off the machine on its pallet. The firm also makes an open-pan type of concrete mixer.

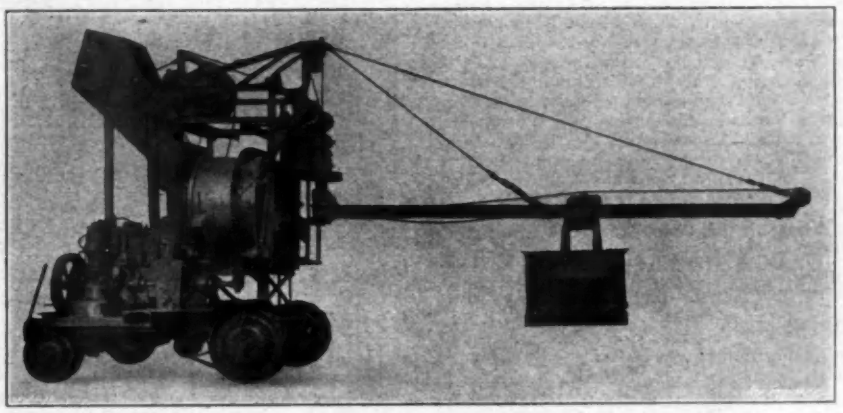
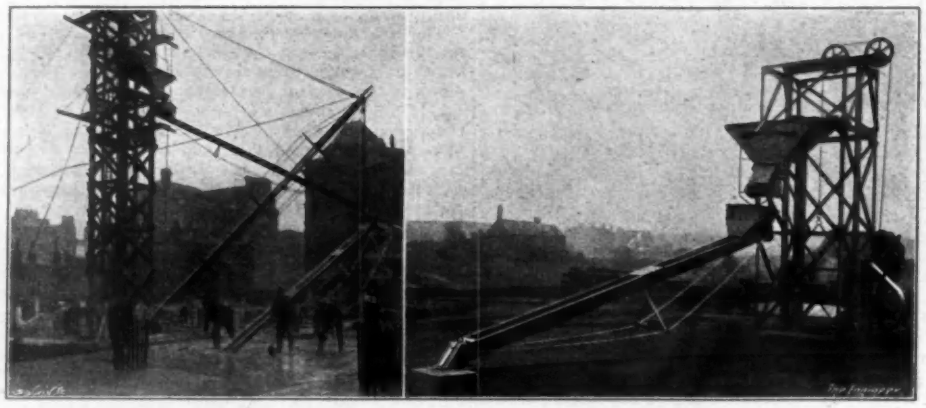


FIG. 27—LATEST TYPE OF RANSOME MACHINE FOR STREET WORK

FREDERICK PARKER.

A portable self-contained stone crusher and concrete mixer, known as "The Ideal," which is made

by Mr. Frederick Parker, of Dun's-lane Engineering Works, West Bridge, Leicester, is shown in Fig. 19. It requires but little description, as the engraving is self explanatory. The maker lays stress on the facts that mixing takes place under the eye of the operator, so that the desired consistency may be obtained without difficulty, and that the action of the mixer is a pouring one, which Mr. Parker maintains is the only correct method for accurately mixing concrete. The batch is mixed and poured four times during every revolution. The mixing pan revolves on ball bearings, and the whole equipment has been made specially strong so that it may withstand the rough usage that it is likely to experience at the hands of contractors' labourers. The ingredients are fed into the pan by means of the loading skip which, it will be noticed, is mechanically elevated. The mixing water is supplied from a tank which is carried on the same framework that supports the skip-raising shaft, and which can be made to deliver at each discharge exactly the requisite quantity of water. For this purpose the height of the ball cock can be varied. An indicator is provided which shows the quantity of water contained in the tank. The discharge takes place on the opposite side to that on which the machine is fed. The machine is made in five sizes, varying from 4 cubic feet to 27 cubic feet capacity per batch. Size No. 1 has hand-discharging gear, but the larger sizes are fitted with a power-discharging gear, which has an automatic safety device. The smallest machine can actually be worked by hand, or needs only ¾ brake horse power to drive it. The brake horse powers required for the other sizes are :—No. 2, from 4 to 6 ; No. 3, 6 ; No. 4, 9 ; and No. 5, 12.



FIGS. 29 AND 30—EXAMPLES OF CONCRETE DISTRIBUTING PLANTS—RANSOME

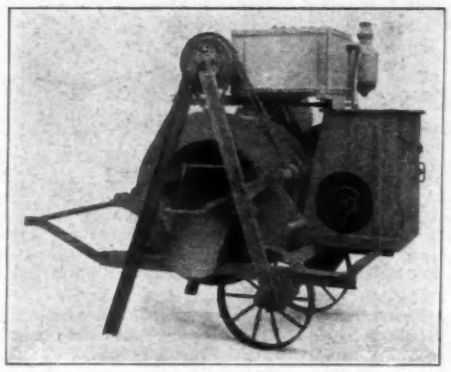


FIG. 31—SMALL VICTORIA MIXER—STOTHERT & PITT

The mixing pan is made up of a cast iron bottom and the sides of mild steel riveted together. Cast with the pan is a toothed driving ring which works in trunnions so that it can be tipped to one side or the other for loading or discharge. The drum revolves on ball bearings, the speed being about 30 revolutions per minute. The mixing angle is about 45 deg.

RANSOME MACHINERY COMPANY (1920), LIMITED.

One of the largest makers of concrete machinery and auxiliary equipment is the Ransome Machinery Company (1920), Limited, the head office of which is at 14–16, Grosvenor-gardens, London, S.W. 1. In describing some of this firm's machines and equipment, the opportunity may be taken at the outset of emphasising the fact all of them have been in the past and are to-day entirely of British manufacture throughout. Whilst it is true to say that the Ransome mixer originated initially in the United States of America, it is nevertheless true to say that when the company took up the manufacture here for the home and British Empire markets, the designs of every machine were re-made in their entirety, so as to embody at every point recognised standard British practice and experience.

The standard Ransome concrete mixer is constructed in a series of seven sizes, which range from a small machine having a batch capacity of 2 cubic feet of mixed material, to the largest machine, which has a batch capacity of 2 cubic yards of mixed material. On all Ransome machines there is provided on the feeding side of the mixing drum a fixed or elevating hopper, the capacity of which is such that it accommodates the required batch of loose aggregate with cement for each size of machine. The revolving mixing drum is cylindrical in form, and contains inside it a special arrangement of lifting and cross mixing wings, which are claimed to be of such form that for each complete revolution of the drum the whole of the batch within is completely turned over and cross mixed once. The average time of turning of the batch of material within the mixing drum may be as short as 30 sec. or as long as 60 sec., and as a minimum each batch of material receives a complete kneading operation ten times, and at a maximum twenty times. When the mixing process is finished the contents are discharged from the mixing drum by a chute into the receiving vessel for conveyance to the point of final deposit in the structure. As an adjunct to each machine there is fitted a water tank and water service whereby the requisite amount of water for each batch of material is allowed to enter the mixing drum at the required time.

The Ransome machines can be fitted with any type of direct-coupled power. Fig. 20 gives a typical illustration of a mixer fitted with direct-coupled electric motor, and also with a feeding hopper of the elevating type, the latter being shown in the position in which it discharges its measured contents into the mixing drum.

This company has recently introduced a new form of run about light-weight concrete mixer. The machine is of the ordinary batch type, and it has a capacity of 5 cubic feet and an output of 5 cubic yards of mixed concrete per hour. It is mounted on two wheels, and may be readily moved about. It is driven by a small oil engine, which is arranged within the frame. The drum is of the tilting type, and is at such a height from the ground that it can discharge into hand barrows, tip carts, &c.

The larger sizes of Ransome mixers have been applied most generally to work in connection with the construction of docks, harbours, breakwaters, aqueducts, and the like. The machines selected for such work generally range in size from a batch capacity of 1 cubic yard to the largest machine with a batch capacity of 2 cubic yards. Many instances of the machines being employed on this class of construction could be cited, including the outstanding case of the construction of the Rosyth naval base, where, we believe, all the machines employed were Ransomes, but it will suffice for our present purpose to refer to one or two typical types. Fig. 21 shows a machine mounted on a travelling gantry, numbers of which have been supplied for block-making purposes. The mixer is fed by a skip of the elevating type from ground level, and is itself arranged on the gantry girders, each batch of material as mixed being discharged into a wagon running to and fro on the gantry, this wagon depositing material into block moulds below. The equipment is made to travel so that it can pass along the block yard over the various moulds laid out therein.

Fig. 22 illustrates a machine supplied to the Mersey Docks and Harbour Board for use on a 4ft. 8½in. gauge line. It is interesting, inasmuch as it shows the elevating skip arranged to descend at the end of the machine instead of at the back of the machine as previously referred to in Fig. 20. The engraving shows the standard Ransome equipment with direct-coupled steam engine and boiler attached. Another typical illustration of the firm's mixer applied to dock and harbour work is shown in Fig. 23. In this case the mixer, one of four supplied for the construction of the recently built Royal Albert Dock, was housed in the leg of a large travelling Goliath, its position at that point facilitating in that particular instance the supply of aggregates and the delivery of the mixed material from machines to the receiving wagons.

It is sometimes assumed that the application of concrete mixers for the construction of concrete roads and concrete foundations for wood block paving and the like is of novel introduction. That assumption, however, is quite erroneous, as, at any rate, Ransome mixers have been supplied for that particular class of work for a number of years. The early machines were doubtless somewhat primitive, and up to a point limited in their application, as compared with the present-day machines ; but there must obviously be development in all phases of industry, and that remark applies equally to the application of concrete machinery to various classes of work. As an interesting illustration of the early application of Ransome machine built specifically for street work, reference may be made to Fig. 24. This machine, which was put to work some ten years ago, is still reported to be carrying on active operations in the Manchester district. It will be observed that the elevating skip was caused to descend at the end of the machine instead of at the back, and that the motive power was a steam engine and boiler, the latter being of the Spencer-Hopwood compact type.

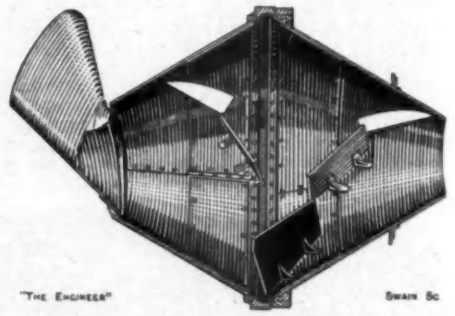


FIG. 34—DRUM OF SMITH MIXER—STOTHERT & PITT

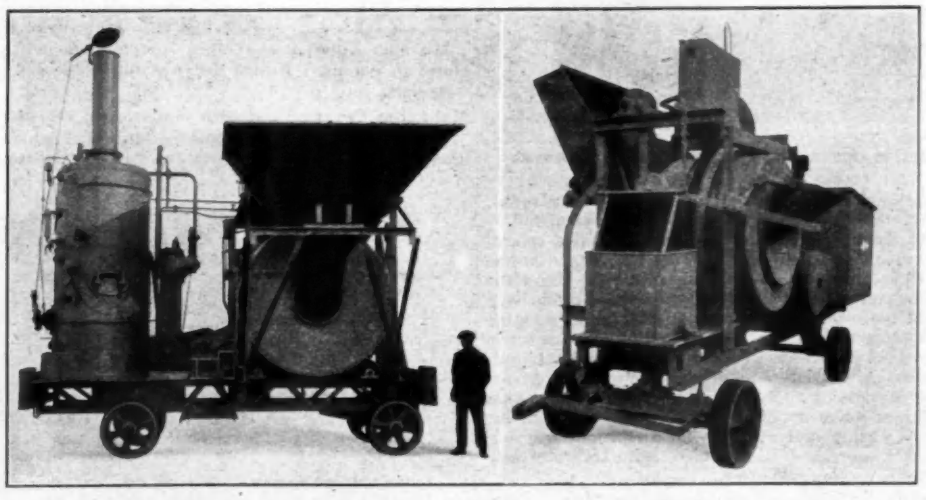


FIG. 32—No. 6 VICTORIA MIXER—STOTHERT & PITT

FIG. 33—No. 2½ VICTORIA MIXER—STOTHERT & PITT

As a later development in the Ransome mixer as applied specifically to street construction, reference can be made to Fig. 25. Here the machine illustrated is fitted with a direct-coupled petrol engine, and it is typical of a large number which have been supplied for work in London, Bradford, Manchester and Salford, &c., on concrete road foundations. As

the most recent development of the Ransome mixer applied specifically to street work, attention may be drawn to Fig. 27, which shows a machine which might possibly be described as being somewhat on American lines from the point of view of type. The machine is, however, without the cumbersome embodiment of a somewhat weighty steam engine and boiler, and consequently its total weight does not exceed 6 tons. Assuming the pavement to be 6in. thick, then its output in superficial yards per day would be 300, an area which, under all ordinary circumstances, is the maximum which can be covered in a day's work on street operations. The mixing drum is fed at the back of the machine by an elevating skip shown in its raised position. The discharge from the mixing drum is into a travelling skip operating on a suspended boom, the boom itself being hinged so that it can swing through a radius of practically 180 deg. All the motions of the machine, including elevating, mixing, travelling of the skip along the boom, and the travelling of the machine itself, are mechanically operated, the various motions being put in and out of gear by a series of clutches at the necessary points. Only one man is required to carry out the complete cycle of operations on the machine itself, and its self-propelling characteristic enables it to be readily moved along the road as concreting proceeds. The boom itself has a radius of 16ft., and inasmuch as it can swing through 180 deg. it follows that the machine distributes its mixed materials over a road surface up to 30ft. The travelling skip on the boom is fitted with bottom opening doors, which can be partly opened out so as to allow the material to discharge in a stream as the skip travels along the boom, or alternatively by the complete opening of the doors instantaneously, at one point.

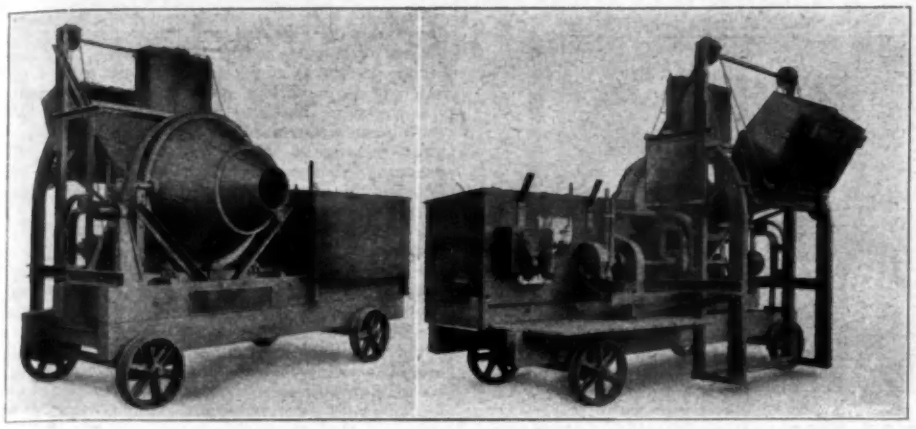
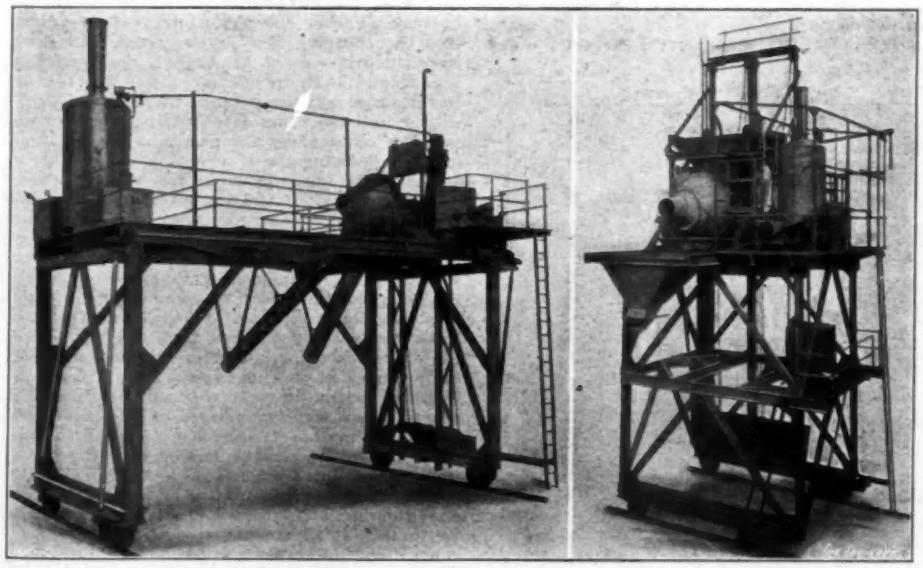


FIG. 35—MOTOR-DRIVEN SMITH CONCRETE MIXER—STOTHERT AND PITT

In connection with building construction, mixers are principally applied to reinforced concrete structures, and in very many of the buildings of outstanding note recently constructed in the large cities in this country, whether for factory, administration, or Government purposes, the Ransome machines have played a prominent part. It is generally found in buildings that, after the construction of the foundations and basement, the necessity arises for elevating the mixed material. Fig. 26 illustrates a typical Ransome machine to which is attached, as a self-contained portion of the plant, a hoisting gear, which is capable of lifting the mixed batch of material as discharged from the mixing drum. For every size of mixer the firm constructs there is a corresponding size of self-tipping hoist bucket. In Fig. 28 will be seen a Ransome bucket discharging its load into a receiving hopper, which latter is, in turn, fitted with a discharge gate whereby the material as delivered can be fed in the required quantity to fill hand carts, to be conveyed to where it is to be used. In building construction a usual arrangement is to have a mixer with an elevating hopper arranged in the basement of a building. Near by is a hoist to receive the mixed charge from the mixer, and to elevate it to the various floors as the building increases in height. Messrs. Ransome specialise in plant of the kind and also in arrangements for distributing concrete over wide areas. Fig. 29 shows the continuation of a hoist tower above the floor level of a building. It will be noticed that on the hoist tower is a receiving hopper, and the conrete is delivered through a chain of distributing chutes to the point where it has to be placed on the floor or roof of the building.



FIGS. 36 AND 37—SMITH MIXERS ARRANGED FOR DOCKYARD WORK—STOTHERT AND PITT

One factor has to be borne in mind when using this class of equipment, and that is the percentage of water added to the aggregate and cement. The tendency, in order to use slack angles of inclination on the chutes, has been latterly to make the concrete more and more wet. That undoubtedly facilitates the handling process, but from an engineer's point of view it has to be remembered that, when the percentage of water in the concrete tends to exceed something in the neighbourhood of 9 or 10 per cent., there is a corresponding fall in the strength of the finished concrete. If chutes are employed, therefore, their inclination should always be such that they will handle concrete without any undue percentage of moisture. The particular elliptical form of the Ransome chute is claimed to render it specially applicable to the handling of concrete containing a normal and proper percentage of moisture.

The illustration just referred to shows the hoist tower accommodating the bucket in a timber construction. When it is found, however, that after completion of any one contract there are others on to which the same equipment can be used, there are undoubtedly many advantages in adopting the steel frame hoist tower. The firm has in the past supplied a number of steel framed hoist towers, and they have nearly all varied according to the height to be ascended and the particular size of equipment in question. As illustrating a typical section of steel hoist with its auxiliary equipment, we may direct attention to Fig. 30. In it will be seen a section of steel framed hoist tower with bucket in position, hoisting winch attached, the receiving hopper, and distributing chute.

Before leaving the products of the Ransome firm, we would refer briefly to a machine which it recently constructed for the Great Western Colliery Company, Pontypridd, and which has been specially designed for working underground in coal mines. For that reason it is operated by a compressed air engine. The unmixed material is raised by a skip working up an inclined frame. The mixed material, as discharged from the mixing drum, is fed into a second skip, which is then hoisted up an inclined jib. The jib itself is made so that it can be readily raised or lowered on the one hand to vary the level at which the skid deposits its load, and on the other hand to facilitate the passage of the machine from point to point along the comparatively restricted avenues in the underground working.

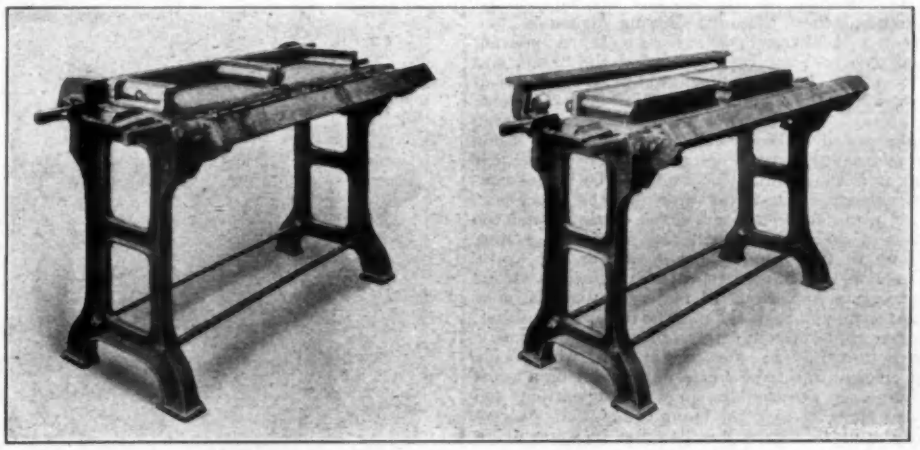


FIG. 38—THE "DUSSITORL" CONCRETE BLOCK-MAKING MACHINE—THOMAS

With regard to the labour employed in operating its machines, the firm claims that, except in the case of, possibly, the largest size of mixer, only one man is required in attendance on the machine itself. The labour employed in feeding and taking away the material will naturally vary with the circumstances and the size of the plant.

Stothert and Pitt, Limited.

To its output of world-renowned cranes and other products, Stothert and Pitt, Limited, a good many years ago now added the manufacture of concrete-mixing machinery, and has more recently been supplying concrete distributing plants of various types. The particular mixers which it makes are named the Victoria and the Smith. The former is of the revolving drum non-tipping type. The machine is made in a number of sizes, ranging in capacity from 3½ to 54 cubic feet of mixed concrete per mix. In the simplest and least expensive form in which it is made, the machine is mounted on steel skids, and is provided with an ordinary feed spout and with fast and loose pulleys for a belt drive. Larger-sized machines are driven by internal combustion or steam engines or by electric motors, in accordance with the requirements of the purchaser. The feed spout, with which alone the simpler machines are fitted, is only intended as a means for passing the materials which it is desired to mix into the drum. When the question of initial outlay governs the choice of plant, and when speed of mixing is not of vital importance,

the ordinary feed spout will meet the needs of the case and give good results. In most cases, however, output is of first importance, and the makers lay strong emphasis on the fact that the output of the Victoria mixer practically depends on the method of feeding. The mixer, they assert, will turn out thoroughly well-mixed concrete as fast as it can be fed, and that therefore special attention paid to the feeding arrangements will in a very short time amply repay any extra expense involved.

Before going on to discuss particular sizes of the Victoria mixer, we may usefully, perhaps, describe the general features of the machine. The most important part is, of course, the mixing drum. The original designer of the machine started on the assumption that thorough mixing demands two distinct movements of the mass:—(*a*) A pouring action to give a constant turning of the batch, and (*b*) a strong sidewise movement to avoid vertical strata across the drum. To fulfil these conditions, the drum of the Victoria machine has four large hopper-shaped blades which are fixed to the inside of the drum shell, and are nearly as wide at their bases as is the drum. The walls of the blades converge at approximately the same angle on either side. As the drum revolves, each blade carries round the mass and pours it through the restricted opening back on to the drum, where it spreads out again. This action, continually repeated, produces a strong reciprocating movement of material from the ends to the centre and back again. The makers claim that, in other words, it completely fulfils the requirements of a perfect mixer; that the system, while being most efficient in mixing action and producing a quick discharge, is exceedingly simple in operation and reduces clogging to a minimum; and that whereas splashing is frequently troublesome in some cylindrical drum type mixers in which the design of the blades is such that the materials when being mixed are thrown towards the ends, splashing is avoided in the Victoria mixer, since the material is always thrown towards the centre.

The drum is made of mild steel, riveted together and furnished with dished steel ends, in which are made central circular openings. The feeding or charging end is provided with a stiffening drip ring riveted on, while the discharge end has riveted to it a concave ring which extends some little way into the interior of the drum, but not far enough to interfere with the fall of the material being mixed as it descends from each of the mixing hopper blades.

The revolution of the drum is brought about by means of a toothed pinion, which gears with a toothed ring riveted to the drum and arranged centrally in its length. On each side of the ring is a roller path, and the drum rests on four rollers which are carried on two shafts running in bearings mounted on a channel iron frame.

When mixing is complete the concrete is discharged by means of a shoot, which, while mixing is in progress, is shifted into such a position that no concrete is caught by it. The simplest form of discharge shoot mechanism is worked by hand, and is shown in Fig. 31, which represents one of the smallest mixers which the firm makes. Its capacity is from 4½ to 6 cubic feet unmixed, or, say, a mixed batch of from 3 to 4 cubic feet. It is chain driven, and can either be operated by two men, each working a handle, or driven direct by an internal combustion engine or motor. It can also be fitted with fast and loose pulleys for a belt drive. As seen in the engraving, it is coupled to a small petrol engine. The plant is carried on two wheels, and the weight of the power unit is so disposed as to balance the weight of the drum in such a way that the mixer can be moved about from place to place by one or at most two men.

FIG. 39—"DUSSITORL" MACHINE ARRANGED FOR MAKING BRICKS—THOMAS

As seen in the engraving, the discharge shoot is in the discharging position. When not required for that purpose it is pushed upwards by means of the hand rail through an angle of approximately 90 deg., so that instead of pointing downwards the discharging edge points upwards, and the mixer end of the shoot is swung clear of the discharge from the mixing blades. The arc of action of the shoot is considerably increased by the cone-shaped form of the ring in the end plate of the drum, though the actual orifice is no larger than that on the feeding side. The shoot is balanced in any position, so that it can be readily moved. We understand that its manipulation is so simple that any quantity of concrete from a spadeful to a complete batch can be discharged at will.

Of larger sizes of the Victoria mixer, two examples are shown in Figs. 32 and 33 respectively. The former represents a No. 6 machine which has an unmixed capacity of 80 cubic feet, and gives a mixed batch of 54 cubic feet. The drive is by means of a steam engine, and the whole plant, which is self-contained, is mounted on flanged rail wheels. The large mixers, of which the engraving shows one example, were supplied with batch-measuring hoppers, it being the intention to load the unmixed materials into the measuring hoppers by means of a crane alongside. With a batch-measuring hopper it is possible to obtain the largest possible output from the machine if the hopper can be filled by means of a crane, or if the feeding level is above the mixer, so that contractors' tip wagons or carts can shoot the aggregate straight into the hoppers.

Such facilities are not, however, always available, and in cases in which the unmixed material is situated on a level with the mixer wheels, the firm provides mechanically operated side loaders, such as that shown in Fig. 33, which represents a No. 2½ Victoria mixer, having a mixed batch capacity of 15 cubic feet of concrete, and being driven by a 10 horse-power twin-cylinder petrol engine and mounted on a heavy road wheel truck, furnished with a swivelling fore-carriage. The side-loading attachment consists of a bin which is capable of taking a full charge, and is fitted with two carrying axles, the ends of which are furnished with flanged rollers, which run on curved guide ways forming part of a rigid framework secured to the mixer base. The guideways are so shaped that, not only do the flanged wheels of the bin carriage never leave them, but the shoot is directed into the charging hole in the drum, and the bin itself tilted up so that its charge is shot quickly into the drum. Both mixers are fitted with an automatic water-measuring tank, which is designed to deliver into the drum exactly the amount of water which is required by the particular combination of ingredients being mixed.

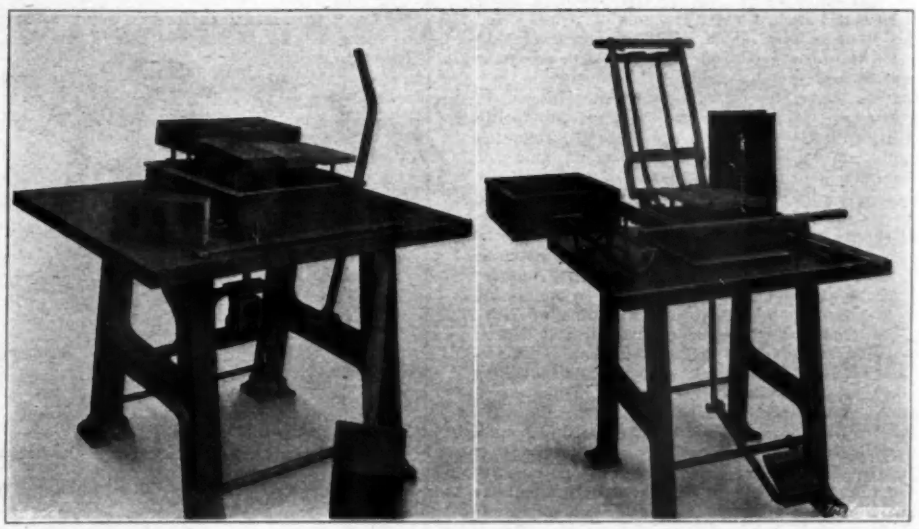


FIG. 40—BRICK-MAKING MACHINE—VICKERS

FIG. 41—ROOFING TILE-MAKING MACHINE—VICKERS

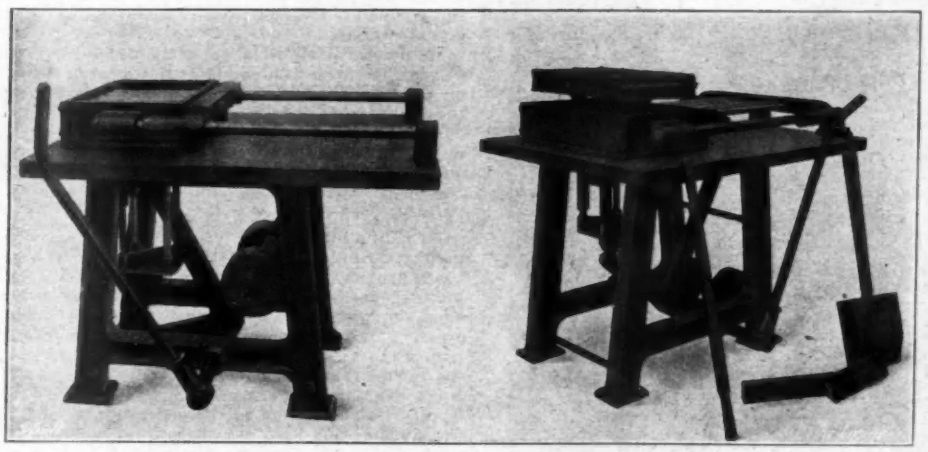


FIG. 42—CONCRETE PARTITION SLAB AND PIPE-MAKING MACHINE—VICKERS, LIMITED

The Smith mixer is unlike the Victoria mixer in several respects. In the first place, the body has the shape of two truncated cones with their bases arranged together—see Fig. 34. Then, again, the drum is not fixed, but is carried in a U-shaped frame which turn on trunnions, and, to discharge the mixed concrete, the frame and drum are tilted by means of a quadrant rack gear. Furthermore, the mixing blades are entirely different from the box blades of the Victoria machine, being simply plain blades, which are arranged in alternate spirals, and the action of which is constantly to turn the materials over and also to impart to them a strong lateral motion. The makers claim that the conical shape of the drum materially assists in the mixing action, while the whole arrangement produces a thorough and uniform mixture. The machine is fed and discharged while it is running. The tilting for discharge only calls for quite a small amount of power, since the load is not lifted but is swung round its centre of gravity. Moreover, as soon as the drum starts to tilt, the load assists the discharge.

There is one other point in which the Smith differs from the Victoria mixer. It is that the drum has only one roller path, and that it rests and revolves on two supporting rollers and not on four. End play is prevented by subsidiary rollers, which press against the sides of the toothed driving ring on the one hand, and the edge of the roller path ring on the other hand. It is claimed that as all the guiding and driving

surfaces of the drum are on a single ring casting, they cannot get out of alignment, and that being placed at the greatest possible distance from the points of feed and discharge, they are naturally protected from getting clogged with concrete.

The general construction of the Smith machine will be gathered from Fig. 35, which shows two views of a standard machine fitted with a side loader and driven by an electric motor, the whole being mounted on a flanged wheel truck so as to be self-contained.

The Smith is made in five standard sizes, the smallest of which will turn out from 6 to 10 cubic yards of mixed concrete per hour, and requires 4 brake horse-power for its operation, while the largest will produce from 60 to 120 cubic yards per hour, and calls for 25 brake horse-power. As with the Victoria mixer, the simplest and cheapest form of Smith is simply mounted on skids and furnished with fast and loose pulleys for a belt drive.

Messrs. Stothert and Pitt inform us that, on account of its high speed of discharge, the Smith mixer is frequently chosen for dockside contracts and other work in which mass concrete is required in large quantities, and they have supplied us with two photographs, which are reproduced in Figs. 36 and 37, showing examples of special arrangements made for such cases. Fig. 36 represents a plant designed for making blocks for harbour construction work. Fig. 37 also shows a dockyard plant which is similar to the foregoing, but the arrangement of the driving mechanism is somewhat different. Both plants are self-propelling.

To meet the increasing demand which has sprung up in this country for the most economic means of

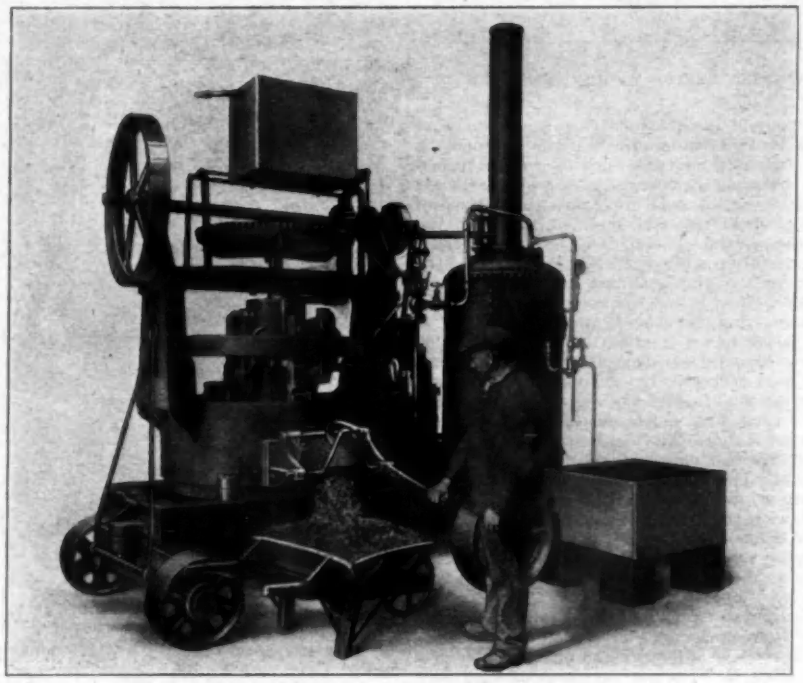


FIG. 43—THE WHALLEY CONCRETE MIXER—H. J. WEST AND CO.

distributing concrete while constructing large buildings, &c., Messrs. Stothert and Pitt have designed a number of chuting plants. Their standard pattern consists of a braced steel tower with a guideway in which the skip runs. A crane type jib is used to support the extreme end of the main chute and the centre of the balanced extended chute. The whole system of crane jib, chutes, receiving hopper and tie ropes can be readily moved up the structure as the work proceeds. The design has an effective maximum radius of approximately 100ft., and by means of the slewing chutes any point within the area swept by that radius can be served with concrete.

An interesting machine is also made by the Bath firm. It is a steam-driven road paver, having a cantilever boom to give a travel of approximately 20ft. outwards. It is self-propelling, and the power unit drives a mixer, hoists the side loader skip, travels the tipping skip along the boom and operates the slewing motion of the boom. The mixing drum has a mixed batch capacity of from 11 to 12 cubic feet, the loading skip a capacity of 6 cubic feet, and the tipping skip a capacity of 12 cubic feet. The travelling gear is reversible, and is fitted with a differential. The boom can be raised or lowered at will, and can be slewed through an angle of 70 deg. on each side of the centre line of the machine.

Commander George C. Thomas, R.N.R. (Ret.).

The "Dussitorl" is the name of a concrete block-making machine which has been designed and put upon the market by Commander George C. Thomas, R.N.R. (Retired), whose offices are at 227 and 228, Tower-buildings, Liverpool. The machine, as its name which is intended to represent "Does it all"

suggests, is claimed to produce everything in the way of material that a builder or any one who has repairs to property constantly going on may require.

For making two blocks at a time, 18in. long by 9in. wide, and up to 3in. thick, it is arranged as shown in Fig. 38, in the left-hand view of which the machine is seen ready for making the blocks, one of the sides being swung open to show the arrangements of the fillets for giving the blocks their interlocking ends. The right-hand view shows the two blocks moulded. The inventor lays much stress on the fact that a large outlay on costly pallets is not necessary with his machine, since the blocks are not left to harden as made with their broad faces downwards, but are tipped on their edges. They are, as a fact, moulded on a specially designed base or pallet board which can be removed from the machine and returned to it as soon as the block has been placed in the position in which it is to mature. All that is required, therefore, is a number of strips of wood as wide as the blocks are thick, which can be laid against the edge of the block, when the mould box is opened, and on to which the block can be tipped when it is removed to the hardening yard. It is claimed that the process of tipping the blocks on to their edges by means of the inventor's patented device for the purpose does not involve the slightest risk of fracture.

By means of a special attachment the machine can be employed for making twelve bricks at a time. The left-hand view in Fig. 39 shows it arranged for that purpose, while the right-hand view shows it opened out for the removal of the bricks after formation. For the making of bricks there is provided an attachment comprising a series of thin plates, to form the division pieces between the bricks, which attachment can either be swung up by means of the two handles, one at each side, as seen in the left-hand view, and held in position by means of the central catch, or lowered out of the way for the removal of the finished bricks, as shown in the right-hand view. When in the latter position the machine can be used for making blocks, for the division pieces are dropped sufficiently to clear them out of the way.

The machine, in addition to making blocks—the largest it can produce is 3ft. long by 9in. wide and 3in. deep—can produce window sills, steps, headstones, hearths, mantel-pieces, wall coursings, &c.

Vickers Limited.

Among the machines for fashioning various articles in concrete which are made by Vickers Limited, of Vickers House, Broadway, Westminster, S.W. 1, may be mentioned, first of all, the brick-making machine which is illustrated in Fig. 40. With it, so it is claimed, one man can, without any assistance—if the mortar be provided for him—make from 2500 to 3000 bricks per day. The machine is designed to make six building bricks at a time. By simple adjustments arch flooring and other special bricks, as well as tiles and other articles, can be produced. As will be observed in the engraving, the machine consists of a table carried on cast iron legs with a mould box fitted over its centre. The latter is divided into six compartments, which, in the standard machine, are of the correct size to make bricks of British standard dimensions. A steel matrix resting on four adjusting screws, which gauge the thickness, is placed in each compartment. The matrices have four holes, one at each corner, in order to allow lifting pins to pass through. A steel pallet is placed in the matrix to take the concrete forming the bricks, and, by means of a hand lever which is pivoted on the legs of the machine and which actuates the lifting pins, the pallets, when the concrete has been poured into the moulds, tamped and struck off, are raised clear of the mould box with the moulded blocks resting on them. The six bricks are raised out of the machine with one operation of the lever, as may be seen in the engraving, which shows that different shaped bricks and tiles can be made at the same time. When raised they are taken off the machine resting on their pallets. After about twelve hours water is sprinkled over them,

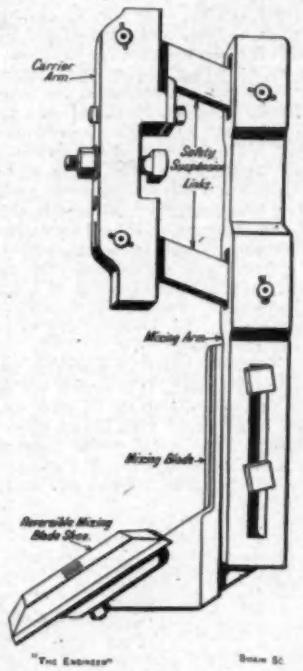


FIG. 44—BLADE-CARRYING ARM OF WHALLEY MIXER

an operation which is repeated twice a day for two or three days, when the bricks may be taken from their pallets and stacked in a yard to harden. They are ready for use in building in about six weeks. The process necessitates the use of a semi-dry mixture, and the makers emphasise the fact that the more water that can be sprinkled over the bricks during hardening the better will be the product.

The portable concrete roofing tile machine which is shown in Fig. 41, and which is also made by Messrs. Vickers, works on practically the same principle as the brick machine; but, as will be observed, it is

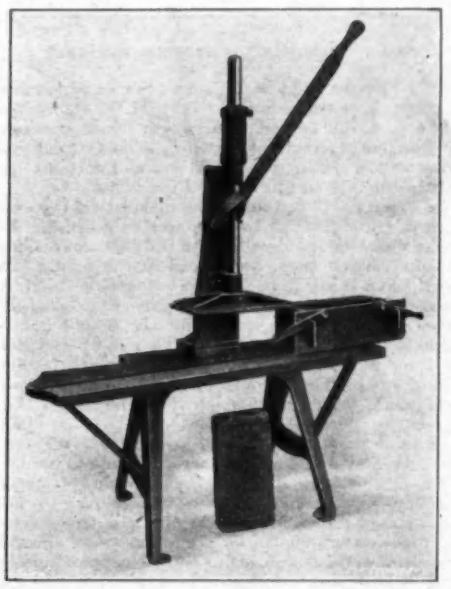


FIG. 45—THE WOLLARD BLOCK-MAKING MACHINE—WEST

operated with a foot lever instead of a hand lever. No matrices are required, as a die-cast pallet is used and is raised out of the mould box by the lifting pins when the treadle is depressed. The mould box is made the exact size of the tile and the pallet just fits it. A colour box having a base of perforated zinc is hinged at the side of the machine and can be moved across the tile for colouring purposes, as explained later. The underside of the tile is formed by the shape of the pallet and the upper face by a steel striker which is provided with the machine. There is also an apron which comes over the tile, when it is coloured, and a head lock is formed at the end of the

tile by means of a head lock former, which is also supplied with the machine. In recommending the use of concrete tiles instead of the ordinary burnt article, Messrs. Vickers point out that with the latter the groove and tongue are more often than not a weakness because of distortion during burning, whereas with concrete the shape is maintained throughout manufacture and full advantage may be taken of an efficient side lock. The tiles made in the machine actually lock on all four sides. Furthermore, it is explained that a concrete tiled roof is considerably lighter than one made with ordinary tiles, the relative weights being as 7 to 12, while economy may be achieved by reducing the number of battens, the spacing of which is 13in. Further, the scantlings may be of common rafters, roof trusses, &c. One man can, it is stated, make from twelve to fifteen hundred tiles per week, including mixing, stacking, &c.

In operation a pallet is placed in the machine and a small quantity of mortar is filled into the mould box and lightly tamped. The superfluous material is then struck off by means of the specially shaped striker, which at the same time forms up the profil of the tile. After the surface has been made smooth the colour box is swung into position directly over the mould and an even layer of dry colour deposited over the face of the tile. Water is then sprinkled over the colour and the face is again traversed by the striker, an operation which is said to result in a glazed face of the required colour. Pressure on the foot lever then raises the tile out of the mould ready to be carried away to racks to harden.

A portable concrete partition slab machine is also made by Messrs Vickers. It is shown in Fig. 42, and it can make any size of slab up to 18in. by 12in. by 4in. Besides being fitted with lifting pins operated, as in the brick machine, by a side hand lever, the machine is also furnished with five steel core rods, which are made to slide horizontally and are also

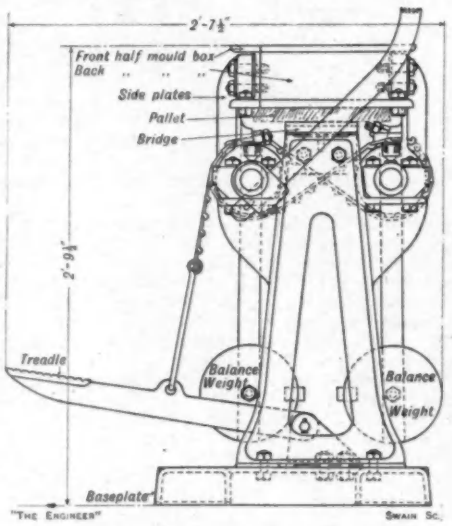


FIG. 46—BRICK-MAKING MACHINE—WHITAKER

operated by the hand lever, one motion of which first of all removes the rods and then lifts the slab. The core rods are all bolted to a casting which slides on two horizontal rods, each of which is held at one end by a lug formed on the mould box and at the other by a casting bolted to the top of the table.

In operation the makers recommend that the concrete mixture shall be used as wet as possible. To form a slab a pallet, together with the fillets for making the interlocking ends, are placed in the mould box and a layer of concrete is spread over it and lightly tamped. The core rods are then moved into position by means of the side lever, and the mould box is filled, tamped, and struck off. To remove the slab the lever is drawn forward, a motion which results, first of all, in the withdrawing of the core rods, and then in the raising of the slab from the mould box, as seen in the right-hand view in Fig. 42. When the interlocking end-forming fillets have been removed the block may be taken away and set aside to harden.

The machine can also be used, by means of special attachments, for making agricultural pipes. The attachments provide either for the making of three 3in. pipes or five 2in. pipes, core plungers of suitable sizes being furnished in each case. A pallet of special shape is also used to form the inverts of the pipe. It is placed in the mould box and covered with a thin layer of concrete, as described for partition slabs. The lever is then manipulated so as to bring the cores into their proper positions. The mixture forming the lower halves of the pipes is then consolidated by means of two small iron tampers. The operator then fills the mould box with mixture, tamps it down by means of a specially shaped iron former which runs on two guide rails, and which shapes the upper halves of the pipes. By again actuating the lever the cores are withdrawn and the pipes raised from the mould box ready to be carried away.

H. J. WEST AND CO., LIMITED.

Comparatively few of the concrete mixers at present made in this country are of the horizontal pan type. A mixer of that class is, however, made by H. J. West and Co., Limited, of 72 and 74, Gray's Inn-road, London, W.C. 1, the works of which are at Saxilby, in Lincolnshire. It is termed the Whalley mixer, and for it several special features and advantages are claimed. For instance, it is claimed for it that it retains the efficient characteristics of manual shovel work, while at the same time ensuring mechanical

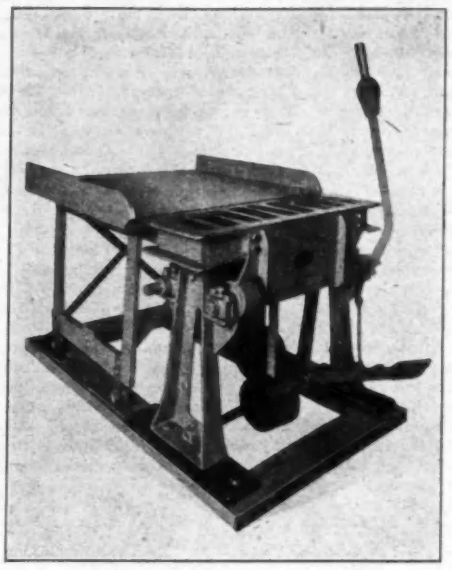


FIG. 47—BRICK-MAKING MACHINE—WHITAKER

thoroughness and uniformity; that it ensures that every particle of the contents of the pan is incorporated into a homogeneous mixture, as every grain is turned over and over again mechanically by specially shaped blades; that with it it is impossible that lumps of imperfectly mixed material shall emerge from the machine, because the specially designed stirring blades cut the material up and spread the liquid part of the mixture over the smallest part of the aggregate. Furthermore, stress is laid by the makers on the fact that all the mixing operation is open to view.

The Whalley mixer is made in two sizes, which have hourly capacities of from 8 to 10 tons and from 16 to 20 tons respectively. The smaller machine, which is illustrated in Fig. 43, has a pan 4ft. in diameter and some 15in. deep, its capacity being one-third of a cubic foot. The larger machine has a 6ft. diameter pan with a capacity just double that of the smaller unit. The machines are supplied either for belt driving or, as shown in the illustration, are self-contained with their own steam engine and boiler, though, of course, they can be driven by any other form of prime mover. The horse-powers required to drive the two machines in full operation are 6 and 8 respectively.

The mixing pan is circular and has vertical sides. The angle between the floor of the pan and the sides, and that between the floor of the pan and a central boss, are filled up with circular rings of hard steel so that the material being mixed does not get into those angles, from which it would be difficult to extract it. The mixing of the aggregate is brought about by means of four blades, which are attached to and revolve with a vertical shaft at the top of which is a toothed bevel wheel. The latter is driven by a bevel pinion keyed on a shaft which may be driven direct from the engine or by belt on the fly-wheel. The blades are so shaped and disposed that as they revolve they conjointly cover the whole surface of the

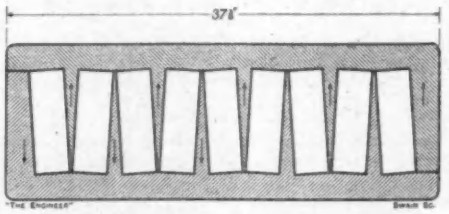


FIG. 48—PLAN OF BRICK MOULD BOX—WHITAKER

pan bottom. They are arranged *en échelon*, and the two which sweep round the centre of the pan annulus are rectangular in shape and have chamfered edges. The other two blades, one of which sweeps round over the ring which fills up the angle at the periphery of the pan, while the other sweeps round the ring at the base of the central boss, are specially shaped so as efficiently to scrape the material being mixed from those rings. The blades are fixed to the mixing arms by means of bolts, and there are slotted or elongated holes, so that the positions of the blades, which are practically the only wearing parts, may be adjusted. The mixing arms are connected to main carrier arms by means of special movable links, which permit of the whole of the mixing arm and blade to float or ride over any fixed obstruction that may find its way into the mixing pan. The carrier arms are in turn bolted to a spider wheel, which is also provided with slotted holes to allow of radial adjustment of the carrier arms and which is keyed to the driving bevel wheel already mentioned. Fig. 44 shows one of the carrier arms with a blade attached. It is the member at the left top corner which is attached to one of the spider arms, the bolt shown being that which passes through one of the slotted holes in the latter. It will be observed that, not only can the fixed height of the blade be readily adjusted, but that the whole arrangement "floats," and is hence not subject to damage should large or fixed obstacles be met with.

The machine is fed by means of a mild steel hopper, which is furnished with a sliding door controlled by a lever carried through to the front of the machine, so that only one man is required to operate both the filling and discharging of the mixing pan.

Although it is not absolutely essential, and is not fitted unless specially asked for, the makers advise the use of their sparging device. Fitted on a revolving spider wheel embracing the vertical shaft is a small cylindrical distributing pipe provided with a number of sparging outlets. When the dry aggregate is fed into the pan the flushing valve is opened and the predetermined correct quantity of water is distributed evenly over the entire pan area, just as is the case in the vats in breweries.

When mixing is complete the concrete is discharged through a door formed in the side of the pan in the front of the machine.

Messrs. West also manufacture one of the simplest block-making machines which we have come across, yet it is claimed for it that it gives highly efficient results and that the blocks made with it may be put

FIG. 49—BLOCK-MAKING MACHINE—WHITAKER

into commission within three days after manufacture. The machine, which is made under the patent of Mr. J. Wollard, and which is illustrated in Fig. 45, makes blocks up to 18in. long by 9in. wide and 4½in. deep, though, of course, smaller blocks and blocks of special shape can be produced by using suitable liners. It is, as will be seen, a hand pressuremachine, and the mould box is so arranged that it can be moved backwards and forwards on a cast iron table carried on cast iron legs. As a matter of fact, though only one mould box is shown in the illustration, two boxes can be, and frequently are, employed in actual service. The mould boxes have hinged end and front walls, which can be clamped tightly together when the mould is closed by means of pivoted levers. Wood or any other kind of pallets can be employed. The procedure in making a block is simply to fill the mould with aggregate, strike it off level with the top, run the box under the press head, and pull down the lever. We have seen the latter operation done by a lad with ease. The spring embracing the press spindle lifts the press head clear of the mould as soon as the lever is released.

R. G. WHITAKER, LIMITED.

The concrete block-making machines of R. G. Whitaker, Limited, Ceres-road, Kingston-on-Thames, may be divided into two distinct classes. In both types the concrete is tamped into open-top metal moulds, but while in one case the mould is withdrawn from the blocks, so that they may be removed for curing, in the other the blocks are pushed vertically out of the moulds after they have been tamped.

The concrete brick-making machine shown in the line drawing Fig. 46 and the half-tone engraving Fig. 47 belongs to the first-mentioned class. It is designed to produce at one operation nine bricks measuring 8¾in. by $2^{9}/_{16}$in. by $4^{6}/_{16}$in., though the actual size can be altered to suit requirements. The

mould is so constructed that its two halves can be withdrawn from the bricks without grazing their faces. As will be seen from Fig. 48, which is a diagrammatic plan view of the mould box, the mould is made in two halves with tapered partitions to separate the bricks. By staggering the bricks in the manner shown in the sketch they are all made rectangular. When the concrete has been tamped into the spaces the two sides of the mould are drawn apart sideways; the tapered partitions naturally come clear of the brick faces immediately the movement commences. A bottom for the mould is provided by a piece of board that forms a pallet on which the bricks may be carried away. Each pallet for nine bricks measures 39in. by 9¾in. by ¾in. The construction of the machine is simple. Two end frames and a connecting bridge, or table, support the wooden pallet. The frames also carry two shafts, one at the front and one behind, to act as pivots for the two halves of the mould box. The relative positions of the various parts are such that the momentary movement of the sides and partitions of the mould, on starting to open the latter, is horizontal, so that the faces of the bricks are uninjured, since there is no rubbing action. The two half moulds then swing up and out right clear of the bricks. The two shafts must, of course, rotate in opposite directions, and for that purpose they are connected by crossed chains which, of course, operate simultaneously. Two chains, which are wrapped round drums in opposite directions, are used so as to keep both in tension during the opening and closing of the mould. The balance weights are so proportioned that the centre of gravity of the moving parts is only raised about one-sixteenth of an inch in the process of opening the mould, which is effected by means of the lever on the right with the assistance of a little pressure on the treadle, the purpose of the treadle being to hold the moulds open if the operator desires to take his hand from the lever. The slight degree of unbalanced effect has the advantage that it ensures the two halves of the mould not being accidentally parted while the machine is in use. A light table on wheels is arranged at the back of the machine and is used for the storage of a supply of concrete. The makers inform us that the output of one of these machines is about 2000 bricks a day.

Two examples of the second type of machine referred to at the commencement of this section are illustrated by Figs. 49, 50, 51 and 52. They are both similar in general principle, but differ as regards the proportion of length to breadth of their product. The machine shown in Fig. 49 is intended for making interlocking concrete blocks or partition slabs, while that depicted in Fig. 52 is used in the manufacture of fence posts, lintels, &c. The drawings, Figs. 50 and 51, show two types of these machines set up for making cored blocks, and show the general arrangement. The mould is formed by two cast iron side plates A A, which are bolted on to the standards A^1 A^1, which serve as the ends of the box as well as forming the legs of the machine. One end frame has a half-round groove running down the inside face, while the other frame has a corresponding tongue, to form the tongue and groove for locking the blocks together when they are built up. A bottom for the box is provided by a wooden pallet, which rests on the top of the plunger B, which may consist of a cast frame as in Fig. 49, or of two rods connected at the bottom by a cross piece as shown in Fig. 52. The weight of the block machine is 6 cwt., and the floor space occupied—without the table—is 3ft. 4½in. by 4ft. 6in.

If it be desired to make hollow blocks the necessary cores C C are bolted on to the bottom flanges of the side plates, as shown in Fig. 51. The cores are generally given a draught of about ¼in. to the foot and the side plates one of, say, one-sixteenth of an inch per foot of depth. The cores, also, are not carried right up to the level of the top of the mould, so that they do not obstruct the strickle board when the concrete is struck off. The plunger or lifter B—Fig. 51—is, it will be readily appreciated, for the purpose of pushing the moulded block out of the mould. It is a cast iron frame, which is guided vertically by the tongue and the groove on the end frames. In the case of machines intended for making hollow blocks the top of the plunger is cut away, where necessary, to clear the cores. In other cases it is quite plain. The plunger is lifted by means of two chains fixed to its bottom member and running over pulleys on short levers to a bar fixed between the main frames. The pulley levers are keyed to a shaft on which the hand lever is fixed. The arrangement gives a one to two gear, which quickly lifts the block on its pallet out of the mould. In the heavier machines,

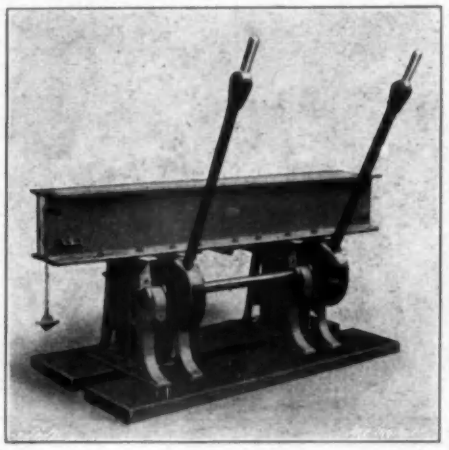


FIG. 52—FENCE POST-MAKING MACHINE—WHITAKER

where there is a large area of contact between the block and the mould, the operator is given an additional purchase to overcome the static friction and start the block moving. For this purpose a bar, which can be seen at D in Fig. 49, is fixed to the lifting levers near to the pulleys. Its position is such that it engages with the links of the chains and has the effect of locking them to the levers as long as the plunger is at the bottom of its stroke. The consequence is that the lifting levers give a direct pull on the plunger, but as soon as the latter commences to move the bar becomes disengaged from the chain and the more rapid movement of the one to two gear is obtained. The thickness of the block may be altered by using packing pieces of different widths, which are inserted between the main frame and the side plates. These packings are of brass, are machined up carefully, and have slots for the accommodation of the bolts, so that they can be slipped in place without it being necessary to take the bolts right out.

In the lintel-making machine—Fig. 52—the two pieces of channel which form the sides of the mould box can be moved to suit the required thickness or arranged at an angle to one another for tapered posts. It is, in fact, surprising how easily these machines can be adapted for turning out different forms of blocks, and only one spanner is required in the process, as all the bolts are of one size—¾in. Whitworth. The lintel, or "Q" type, machines, as the makers call them, are made in three sizes so as to produce work from 4ft. 6in. to 8ft. long. In addition to fencing posts and lintels, they will make kerbs and mullions, &c.

The block and slab machines are made in several types, though they all operate on the same principle and can make either cored or solid slabs or blocks up to a mximum size of 18in. by 9in. by 4½in. The shapes and character of the blocks can, of course, be altered by the use of suitable liners in the moulds. The machines each weigh about 4 cwt. and the floor space occupied is 2ft. 6in. by 2ft. 4½in. The makers emphasise the fact that the blocks are made on edge and not on the flat, which, they claim, produces a stronger and cleaner block than is the case when blocks are produced on the flat, besides reducing the cost of pallets and the area of the drying ground.

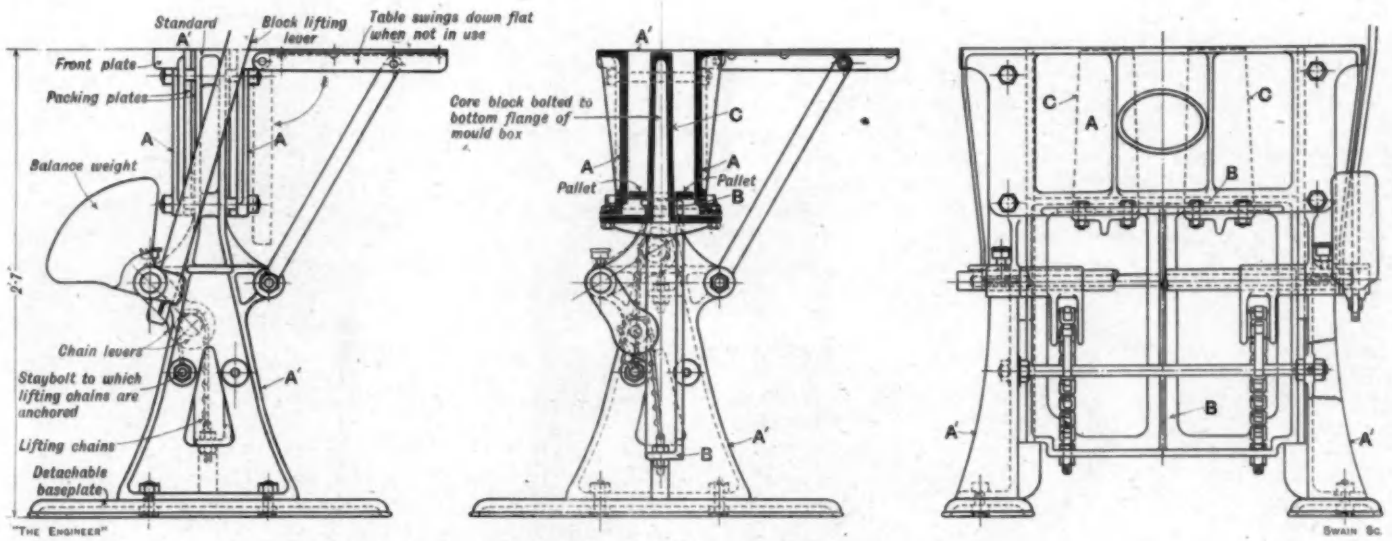
We may say, in passing, that Messrs. Whitaker claim that with their block and slab-making machines any aggregate—wet or dry—can be used with perfectly satisfactory results. They maintain that the principle of stripping a slab out of a fixed mould, which is what they employ in their machines, lends itself to the making of a much wetter and therefore better slab than any other. They are of opinion, however, that the ideal aggregate is to be found midway between the wet and the semi-dry, and they assert with truth that their machines will operate perfectly with such aggregate.

WINGET, LIMITED.

Winget, Limited, the London office of which is at Winget House, Grosvenor-gardens, S.W. 1, claims to be the oldest established firm devoting its attention specially to the construction of concrete machinery, and it has evolved a number of interesting machines not only for the mixing of the concrete, but for the making of it into blocks of various sizes, bricks, tiles, &c.

The Winget "Chain-Spade" concrete mixer is particularly intended for the production of semi-wet aggregate such as is used in the firms block-making machines. Messrs. Winget claim that no other machine can mix in all degrees of wetness with the combined efficiency, speed, thoroughness and reliability of their machine. The general arrangement of the mixer is shown in Figs. 53 and 54. The mixing trough is traversed from end to end by a shaft which has projecting from it a series of twelve steel rods which are technically known as plough arms and which are arranged at different angles. So as to prevent any of the ingredients or mixed concrete from escaping from the trough by way of the holes in the ends through which the shaft passes, the shaft is recessed so as to take heavy protection discs, which are split in halves and fixed to the end cheeks of the trough. The plough arms are made long enough to permit of a certain amount of adjustment in their length of projection from the shaft. The arms are drilled and tapped at their outer ends to take tips of hardened tungsten tool steel, which are held in position by set screws and the amount of projection of which can be adjusted. There are, therefore, two means of adjusting the length of projection of the arms. Steel chains are strung between the arms and also between the arms at each end and hardened steel scrapers which brush against the end plates of the trough.

The mixing of a batch of concrete can be effected



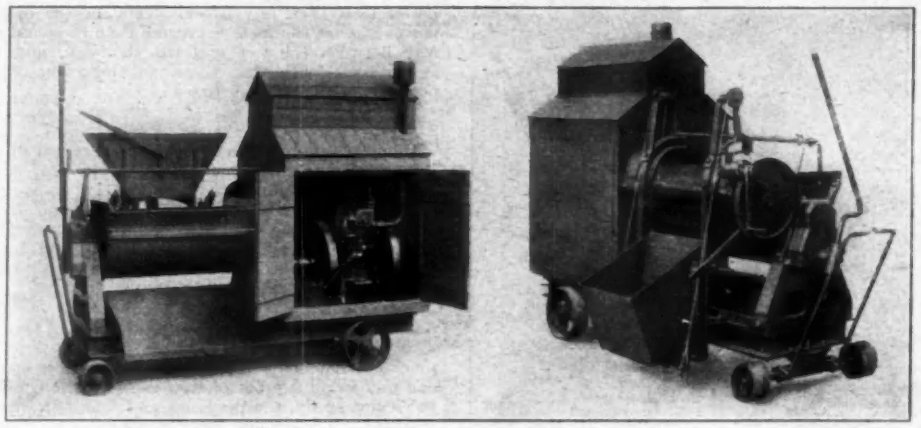
FIGS. 50 AND 51—TWO TYPES OF CONCRETE BLOCK-MAKING MACHINES—R. G. WHITAKER, LIMITED

in less than one minute, so that as many as sixty mixed charges of semi-wet concrete can be passed through the mixer each hour. As the trough holds 3 cubic feet, as much as 180 cubic feet are mixed in the hour, or, say, 66 cubic yards per day of 10 hours. When mixing is complete the batch is discharged by revolving the trough through a quarter of a revolution by means of the lever at the end—an operation which requires the exercise of but little force.

Three horse-power are required to drive the mixer, and the machine can be driven either by belt or by oil engine, motor, or other form of prime mover. In Figs. 53 and 54, which depict a standard arrangement, it is shown driven by a small oil engine. The firm supplies a practically identical plant in which an

electric motor takes the place of the engine. The speed of the engine or motor is reduced by means of gearing to that required for the mixer shaft and the latter can be connected to or disconnected from the gearing by means of a clutch. There is also a slipping device which comes into operation if the arms in the mixer should encounter an obstacle large enough to jamb them.

The machines can either be provided with a fixed charging hopper, as in Fig. 53, or with an elevating hopper, as in Fig. 54. In the first case the discharge of ingredients into the mixing trough is effected by means of a lever-operated vertically sliding door, while in the second case the hopper is turned upside down after being elevated by the hand-worked gearing in a way that will be readily evident from the engraving. The mixing water is supplied to the trough



FIGS. 53 AND 54—POWER-DRIVEN "CHAIN-SPADE" CONCRETE MIXERS—WINGET LIMITED

by an adjustable overhead sprinkler. The water used can first of all be passed through the cylinder-cooling system of the internal combustion engine if that form of prime mover be employed. The machine can either be mounted on road wheels so that it can be hauled from place to place, or it can be mounted on a cast iron base if it is always to remain in one position.

The Winget standard 32in. concrete block-making machine is shown in Fig. 55. It may be termed a general purposes machine, for, by means of interchangeable attachments, it can be made to produce a large variety of different shaped locks, as well as drain-pipes, &c. As shown in the engraving, the mould is closed ready for a block to be made, and there are also in position three core blocks to make a block with holes in it from side to side. As will be observed, fillets on the side and end plates

pallet. Where cores are used, the cores remain in position, so that when the mould is raised by the action of the lever the block is lifted clear of them as well.

In order to make faced blocks, some special attachments are required. It is also necessary to turn the machine frame on to its side, which is effected by releasing a catch by means of the small horizontal lever seen at the end of the machine and turning the frame and with it the mould box over by means of the long lever which has previously been lowered. The special facing material is then tamped on to a mould having the required pattern, which is placed in position on one of the side plates of the mould box, which, by the action of turning the machine over, has become horizontal. A certain amount of rough aggregate is then tamped on the top of the tamped facing material. The machine, frame and mould box are then turned into the vertical position and the filling and tamping of the mould is then completed. The same procedure, but with special moulds and cores, is followed when making drain-pipes. The pipes are all made 9in. long, and may be either 2in., 3in., 4in., or 6in. in internal diameter, a separate set of accessories being needed for each size. The thickness of the material of the 2in., 3in. and 4in. pipes is $\frac{5}{8}$in., and of the 6in. pipes, $\frac{3}{4}$in. Eight 2in. pipes, six 3in. pipes, five 4in. pipes, and three 6in. pipes can be made, respectively, at a time and on one pallet.

It would be impossible here to specify all the different kinds and shapes of blocks which it is possible to make with this machine. The largest block which can be produced measures 32in. by 9in. by 9in., and by subdivision by means of special dividing plates, accessories, &c., an almost infinite variety of smaller blocks, quoins, bricks, interlocking slabs, floor tiles, &c., can be produced. The output per machine naturally varies under different conditions, but the makers assert that, with proper organisation, it should be safe to expect from 300 to 450 "pulls" per working day. That would mean from 600 to 900 blocks, each measuring 16in. by 9in. by 9in. Since every block of that size is equivalent to eleven bricks, the normal production from each machine would, on that basis, work out to a daily output of from 6600 to 9900 bricks.

Another general purposes machine made by Winget, Limited, is known as the "Westminster." It is shown in Figs. 56, 57 and 58. The first shows it with the mould open, the second with the mould closed and with a division plate for making two blocks 9in. by 9in. by 4½in. at one operation. Fig. 58 shows the machine arranged for making bricks. The largest

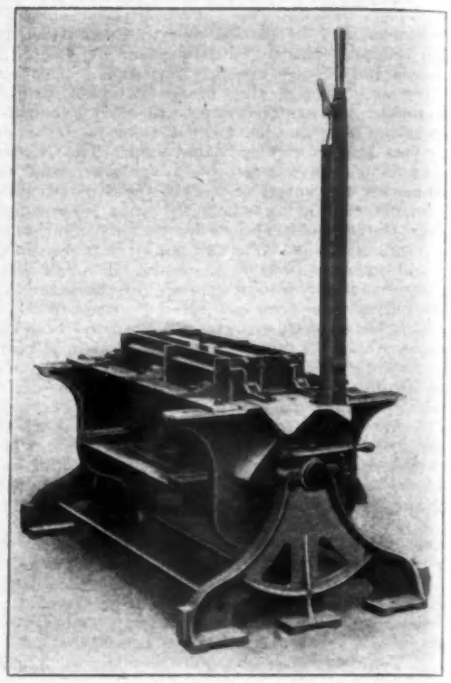
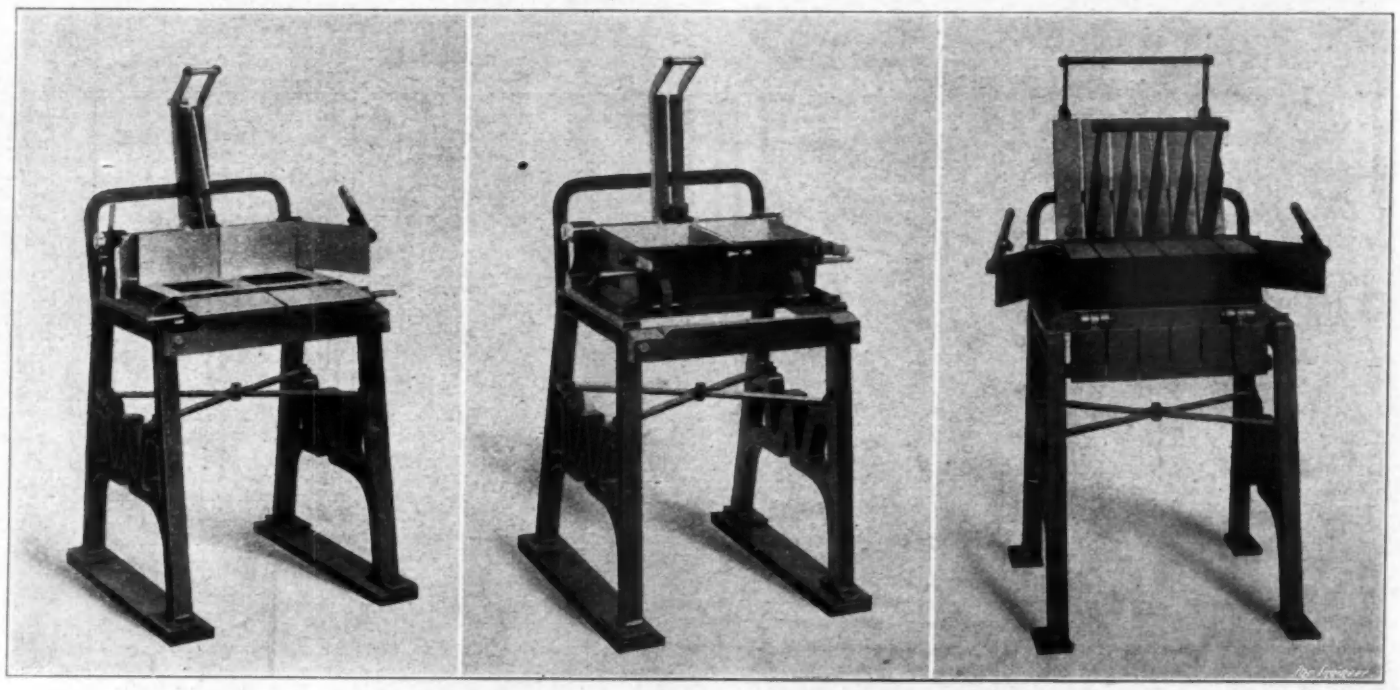


FIG. 55—WINGET STANDARD BLOCK-MAKING MACHINE

single block which can be made with this machine measures 18in. by 9in. by 4½in. The back side of the mould is fixed, while the front side hinges downwards and the ends hinge outwards. The hand levers pivoted on the end plates hold the latter and the front plate securely in position when the mould is closed. The operation of making a block is as follows:—When the mould is closed a pallet is dropped into it. If it be desired to make blocks or slabs of a less thickness than 4½in., then beneath the pallet is inserted a distance piece, or, as the makers call it, a stool. If two or more



FIGS. 56, 57, AND 58—THE "WESTMINSTER" GENERAL PURPOSE CONCRETE BLOCK-MAKING MACHINE—WINGET, LIMITED

press against roller guides so that with the mould lowered ready for block making, as shown in the engraving, the sides and ends are held rigidly in position so that they cannot be forced apart when the aggregate is being tamped. By pulling over the vertical lever the mould with the block in it is bodily raised, and when the side and end pieces are raised clear of the guide rollers, they fall away from the block, leaving the latter free to be lifted away on its

blocks are to be made, the hinged division plate is then lowered into the moulding box, and the concrete fed in, tamped and floated off. The catches are then released and the front and ends fall away from the block, which, on its pallet, can then be lifted away by means of a carrier, made of thin steel plate, which is pushed under the pallet, the latter being provided with fillets on its underside to enable that to be done. If there is or are a division plate or division plates, a

stripping plate, which is hinged to the back of the mould, is brought down on to the face of the concrete, and the division plate or plates pulled up. The stripping plates prevent the blocks being damaged during the process.

When making bricks the "Westminster" machine produces six at one operation. As will be observed, the machine has then to be provided with special side and division plates and a stripping plate. Otherwise the operation is as already described. The six bricks, when made, are all lifted off together on their single pallet. The output of the machine is given as being 40 operations per hour. That would mean 400 18in. by 9in. by 4½in. blocks, or 2400 bricks per day of ten hours.

In the Winget machines described in the foregoing the aggregate is compressed into the moulds by tamping alone. In the machine which is illustrated in Fig. 59 the consolidation pressure is applied mechanically. As far as the mould box itself is concerned, the machine closely resembles those already described, the front sides and ends being hinged and capable of being kept closed by pivoted hand lever clips, which automatically square up the box when they close it. The mould can be rocked forwards or backwards by means of the long side lever. When, as shown in the engraving, the box is swung forward, the side and ends can be hinged away and the block removed. When closed and swung backwards, recesses formed in bosses cast on the underside of the bottom plate are brought over four adjustable hard steel points, which are fixed into the bedplate at the four corners. Only one of the points is visible in the engraving. The arrangement is such that all the stresses are taken on the four points, none of it coming on the rocking levers.

When a block is to be made the mould is filled with aggregate. If it were brought under the pressing plate full, more force would be required to work the machine than could conveniently be applied by one operator. Hence an adjustable plate is employed to screed off a certain amount of the aggregate at the top of the mould. The exact amount screeded off depends upon the consistency of the aggregate and the depth of block being made.

Pressure is applied by means of a cam action worked by machine-cut reduction gear, and the pressure applied is accurately vertical. Three large-diameter guide shafts are attached to the ram plate with the idea of eliminating any danger of producing a tapered block or slab, should the mould box have, by any chance, been filled unevenly. After pressing, the ram plate is withdrawn from the mould by the operator continuing to rotate the hand wheel in the same direction as when pressing. One pull of the lever then brings the mould box forward into a convenient position for the removal of the block, which is effected by means of a carrier as in the other machines.

The makers inform us that at least fifty blocks each 18in. by 9in. by 4½in. can be produced by the machine per hour, and that in actual experience they have found that two men can easily average sixty blocks an hour, even when mixing their own material by hand. In addition to making blocks, the machine can make slabs of the same superficial area and of three thicknesses, 2in., 2½in. and 3in., distance pieces or stools being employed to take up the remaining space in the mould box.

The makers claim that the machine can be worked with the lightest of unskilled labour; that it is so easy to operate that the youngest workmen, or even two girls, can work it efficiently; that it has proved its capacity to produce both blocks and slabs of the highest quality at minimum cost; and that to the best of their knowledge it is the only pressure machine in the world which also makes half-blocks for use as closer or bonding blocks. The machine, as illustrated, mounted on wheels, weighs about 8 cwt.

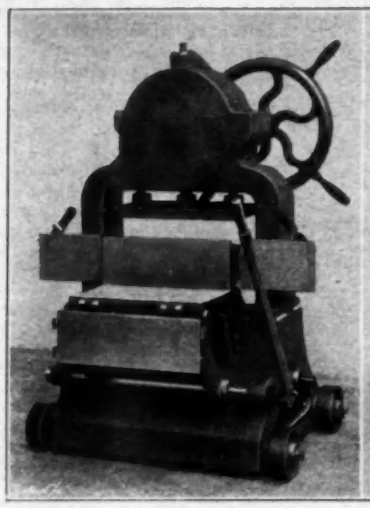


FIG. 59—WINGET PRESSURE BLOCK-MAKER

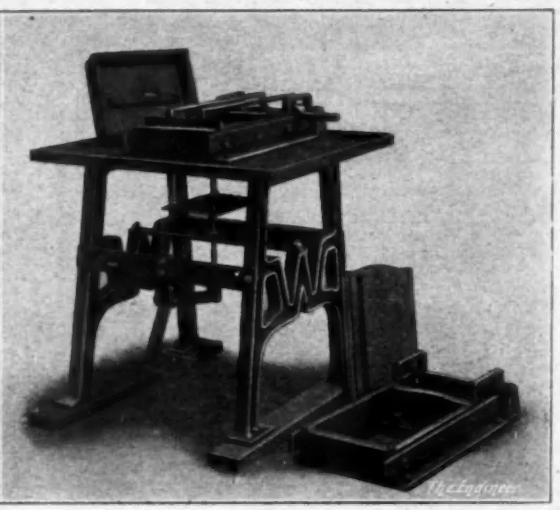


FIG. 60—WINGET ROOFING TILE-MAKING MACHINE

The last of this firm's machines to which we propose to refer is the roofing tile machine, which is illustrated in Fig. 60. With it tiles of practically any shape can be made by using suitably shaped moulds. Of a special type of tile, for which the makers claim the machine is particularly suitable, forty tiles can be produced in one machine per hour, each tile measuring 10½in. by 6½in. The number of tiles of this type required to cover a "square" is from 500 to 600. The weight of the machine alone is 3 cwt. 2 qr.

A New Method of Concrete Mixing.

Just as we go to press with this Supplement, and some considerable time after it had been written, we have had our attention drawn to some new concrete-mixing machines which embody principles which are not shared by any of the other machines that have been described in the foregoing, and which we believe to be entirely new. The machines in question, which are illustrated in Figs. 61, 62, 63 and 64, are made by the Ransome Machinery Company, Limited. They have only quite recently been introduced, and the name of "Aero" has been given to them, since an air blast is essential for their operation.

The outstanding advantages claimed for these machines are, first, that they enable much stronger concrete to be obtained with the ordinary amount cement or alternatively concrete of usual strength with much less cement at much less cost; and, secondly, that "Aero-mixed" concrete is better, more uniform, stronger, more durable and safer than concrete produced by any other known machine or method. The greater strength of concrete is obtained, so the makers explain, (*a*) by the accurate automatic proportioning of the aggregates and cement; (*b*) by the use of a minimum amount of water necessary by means of a water sprayer; (*c*) by the separating of each particle of moistened aggregate as it is brought into contact with the cement; and (*d*) by the complete enveloping of these separate wet particles of aggregate in a continuous cloud of cement that is blown into the drum by an automatic fan, thus ensuring that each separate particle of aggregate is completely covered with an adhering coating of cement as the aggregate is carried round in the revolving mixing drum to the discharge.

At the present time two types of Aero mixers are made. The first, which is illustrated in Figs. 61 and 63, and which is known as the "A" type, has an output of from 8 to 10 cubic yards of semi-dry mixed concrete per hour. The other machine, which is known as the "B" type, and which is illustrated in Figs. 62 and 64, has an output of from 4 to 5 cubic yards of semi-dry mixed concrete per hour. Both are, ordinarily, belt-driven, and for that purpose fast and loose pulleys are provided. The type "B" machine can also be operated by hand. Type "A" machine requires 4 horse-power to work it, and type "B" only 1 horse-power. Only one attendant is, it is said, required, since the machine works automatically.

From the illustrations the functions of each of the different constituent parts of the machines will be readily understood. In Fig. 63, A is the aggregate feeding hopper; B a shaking tray; C a bucket elavator for lifting the aggregate; D the hopper door levers; E the water spray pipe; F the aggregate shoot; G the mixing drum; H the aggregate screen, by means of which the component particles are separated one from the other so that they may be coated all over with cement; J the cement hopper; K the cement feed screws; L a blower for sending the cement in a cloud amidst the aggregate falling from the screen; M the cement controller, which is provided with pointers and scales; N the concrete discharge door; P the fast and loose pulleys; and R a clutch lever for the cement feed. In Fig. 64, A is the aggregate feeding spout; B a water pipe; and C a water tank. It will be noted in Fig. 62 that the machine when the photograph of it was taken had not then had its water tank fixed; D is the mixing drum; E the aggregate screen; F the cement hopper; G the cement feed screw; H the cement controller; J the blower; and K the concrete discharge door.

The makers state that, ordinarily, the "Aero" can be operated continuously, but that it may be stopped and re-started at any time without affecting the ingredients inside. The relative proportions of aggregates, water and cement can be accurately fixed for mixing by the machine for any period, though the proportion of any one or all the ingredients can be altered at any moment.

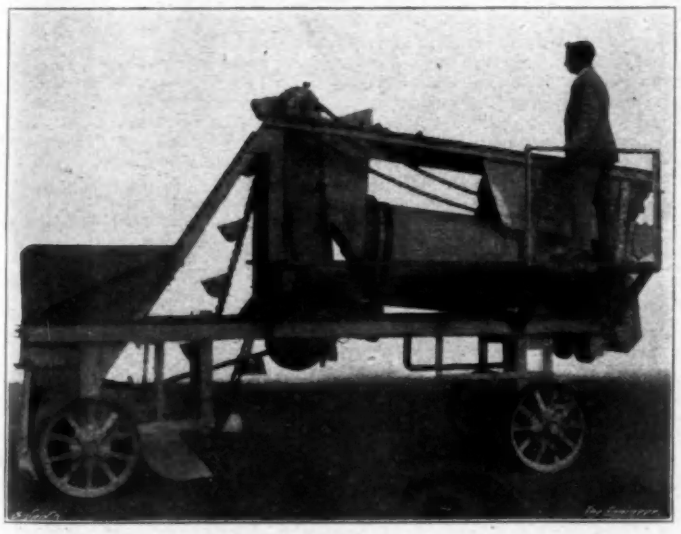


FIG. 61—TYPE A "AERO" CONCRETE MIXER—RANSOME

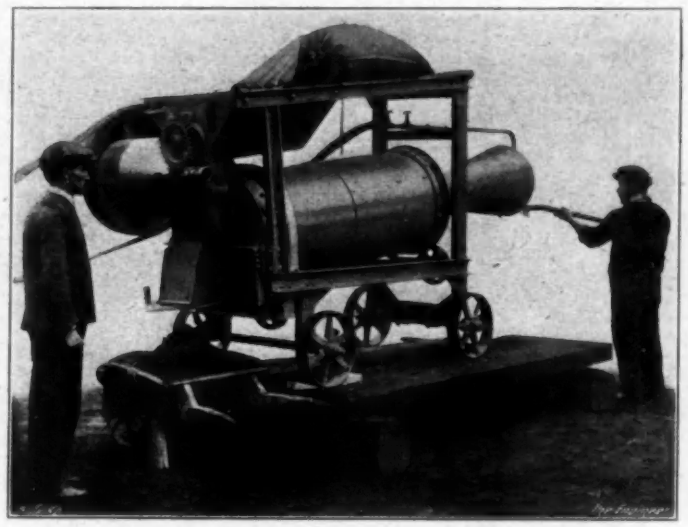


FIG. 62—TYPE B "AERO" CONCRETE MIXER—RANSOME

No pre-hand gauging of the aggregates or cement are necessary, as they are fed into the machine unmeasured and then automatically proportioned by the fixing of the levers and pointers. In fact, it is claimed that the almost entire elimination of hand labour plus the small amount of power required, in addition to the fact that many additional—and hitherto considered useless—aggregates may be used, make "Aero-mixed" cheaper than other concrete, whether less cement is used or not. Much of the success achieved is attributed by Messrs. Ransome

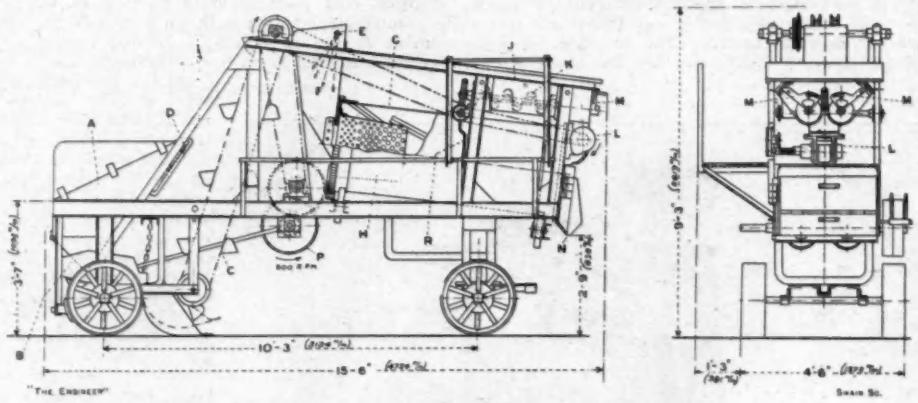


FIG. 63—TYPE A "AERO" CONCRETE MIXER—RANSOME

to the accurate proportioning of all the ingredients, which, they assert, is possible with these machines, and to the complete covering of each separate wet particle of aggregate with cement. "The architect or engineer," they remark, "can guarantee that the accurate proportioning of cement is never varied without his permission by his fixing and *sealing* the cement pointers."

We may add that we have not ourselves yet had an opportunity of seeing either of these machines.

Conclusion.

From the foregoing it will have been recognised that a large amount of ingenuity has been exercised by our manufacturers in the design of concrete-mixing and utilising machines. Between some of the designs there is, of course, a considerable amount of resemblance, but in other cases very different types of apparatus are employed to attain the desired results. We have not, of course, sought to differentiate between the efficiencies in operation of the machines of the different makers, but have confined ourselves to describing the various machines and to explaining how they work.

As we said at the outset, we have found it quite impossible with the space at our disposal to deal specially with machines for crushing and grading the raw materials employed in the manufacture of concrete. There are so many makers of such machines in this country that a whole Supplement might be devoted to them alone. The British crushing machinery maker has certainly nothing to fear, from the points of view of efficiency and reliability, from foreign rivals. Furthermore, we dealt exhaustively with crushers in a Supplement on Portland Cement Making Machinery which was published some years ago.

It is becoming more and more the custom now to employ self-contained concrete-making machines on the actual site of operations. To give an example. In re-making roadways it is quite usual to have a crushing plant to break into small pieces the lumps of concrete torn up from the original foundation, the discharge from the crusher being either passed through a grader or fed direct into a mechanical concrete mixer, and the resulting concrete used for the new foundation. In fact, in every branch of engineering work the mechanical handling of concrete—instead of hand operation—is coming more and more into vogue, and it is safe to say that in a very short time manual labour will be dispensed with entirely, except perhaps for small undertakings. It is quite clear that in the future mechanical means of mixing and utilising concrete will have to be increasingly resorted to. With labour conditions as they are, our engineers and contractors can no longer afford to employ manual labour to the extent which was previously possible. If, for no other reason, concrete-mixing machines must be employed because with them a much greater volume of concrete can be mixed in a given time than is possible by hand. Our machine makers are fully alive to the fact that the call for machinery will become increasingly insistent, and are quite prepared to meet the demand.

By reason of lack of space, too, we have had considerably to curtail those portions of the Supplement which deal with machines and contrivances for distributing and placing concrete. The reason for this is that almost every piece of work calls for special treatment, since conditions vary so widely, and to describe all was impossible. Many clever plants have been devised for dealing with particular requirements, and much skill and ability has been displayed in their production. There is nowadays hardly a single large building in which concrete spouting or distributing plants are not employed, and almost every separate example calls for special arrangements. Many of our firms are prepared to design and provide such equipments.

There are two directions in which, it must be admitted, our manufacturers are behind those of the United States. We believe we are right in saying, for instance, that there is not a firm in this country which is manufacturing a British example of the cement gun or its equivalent. In the United States, on the other hand, it is very widely adopted for a variety of purposes, as our readers are aware, and it is apparently producing some excellent results. Then, again, as far as we have been able to ascertain, our manufacturers have not as yet paid any great amount of attention to the conveying of large bodies of concrete through pipes by means of steam or compressed air, whereas in America such methods are in considerable favour. It may not be out of place here to suggest that in both these directions our own concrete machinery specialists might do well to devote some study.

Taking the concrete machinery and machines as we have found them during the period of preparing this Supplement, we can truthfully say that they are all of them of stout manufacture and well able to withstand the rough usage which they must inevitably undergo. The concrete mixer on a large contract does not receive the handling of, say, an engine running in a clean power station. Concrete making is dirty work, and, no matter what precautions are taken, the concrete is splashed about. Hence, care has to be taken to protect bearing surfaces, and that care is, as far as our observation has gone, nearly invariably exercised. Then, too, concrete mixers, especially those of large dimensions, must be strongly built, and

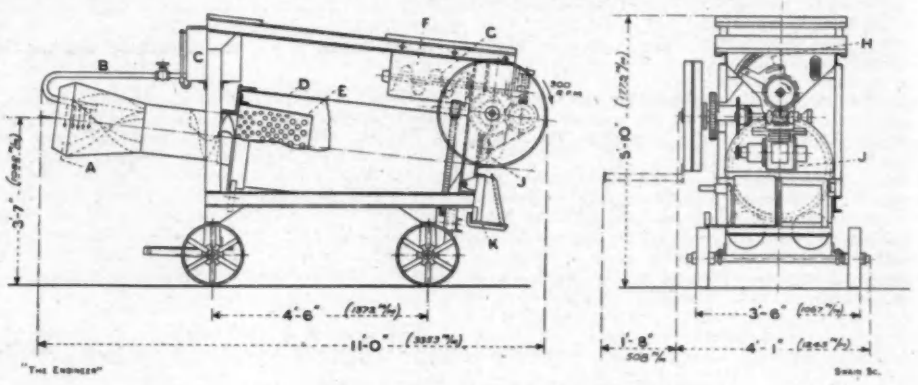


FIG. 64—TYPE B "AERO" CONCRETE MIXER—RANSOME

British machines will not, we think, be found to fail because of over-light sections and plates used in their manufacture. Practically the same remarks can be made regarding our block-making and other machines for handling the concrete when made.

In a word, to repeat what we said at the commencement, there is no necessity whatever for engineers, contractors or builders to go abroad for their requirements. Excellent machines, to meet all requirements, are made by their own countrymen at home.